Western Regional
Climate Center

Designing and Building an Improved Climate Monitoring Network for California

Kelly T. Redmond

Western Regional Climate Center

Desert Research Institute

In coordination with

Scripps California Climate Change Center

Supported by

California Energy Commission

DRI
Desert Research Institute

Scripps Institution of Oceanography
UCSD

Overall goals

Tracking status of climate within the state and the region

- All suitable stations
- Index time series
  - Distillations of more complex information

Identification of useful current stations

Identifications of gaps in monitoring

- For tracking of climate
- For understanding of climate

Development of station inventories, data inventories

Merging and coordinating of existing monitoring efforts

Deployment of new stations / measurements

Dissemination of this information

Derived, gridded, analyzed data under consideration

Inter-related California projects

Enhanced California Climate Monitoring (CEC/CIEE)

Joint efforts with Scripps / CCCC (CEC)

- California Climate Data Archive
  - Calclim : www.calclim.dri.edu
  - Access to climate data / products / information
  - Monitoring climate variability and change in California
  - *California Climate Watch* online newsletter
  - California Coastal Climate Data Archive
- Sierra Nevada Climate Monitoring

Other Related Projects

California Applications Program RISA (NOAA, Scripps)
Blue Oaks Paleoclimate (Calfed, UArk, UAz, Scripps)
Climate Reference Network (NOAA)
Baseline climate activities (NOAA, WRCC)
Climate/weather inventory/monitoring/protocols (NPS)
Westmap Western Climate Mapping (NOAA)
Cooperative network upgrade / NERON (NOAA)
Caljet/Pacjet program successor – SHARE (NOAA, others)

California Climate Data Archive

Western Regional Climate Center
Scripps Institution of Oceanography
California Energy Commission

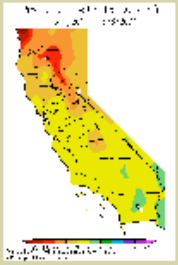
HOME | DATA & PRODUCTS | CLIMATE MONITORING & FORECASTS | CLIMATE RESEARCH | LINKS

About Us
Project Partners
Contact Us
California Climate Watch

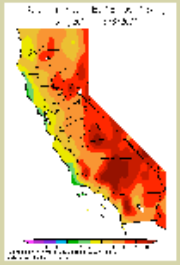
April 2004 Climate Watch

Highlights:
- Monthly Weather Summary by Bill Mork, California Department of Water Resources
- Feature Story: Vegetation Adaptation and Migration
- Monthly Weather Data and Recent Climate Maps
- Climate Forecasts and Outlooks: ENSO, Fire, Hydrology

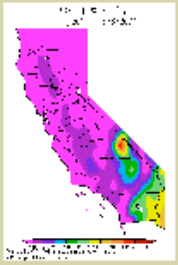
Current Climate Maps:



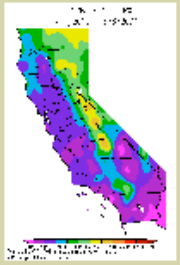
Month-to-date Precipitation Anomaly



Month-to-Date Departure from Average Temperature



Cooling Degree Days since Jan 1



Heating Degree Days since Jul 1

Click here to see other products like this.

HOME DATA & PRODUCTS CLIMATE MONITORING CLIMATE RESEARCH LINKS SITE MA
CONTACT US E-MAIL WEBMASTER

www.calclim.dri.edu

Contact:
Laura Edwards

July 2005

VOLUME ii, ISSUE 7

California Climate Watch

A monthly newsletter monitoring California climate

Highlights:
- More stations added in Monthly Data section
- Brand new look!

July Quick Look:
Average Temperature: 74.1
Average Maximum: 88.1
Average Minimum: 60.1
Precipitation: 28% of average

Inside this issue:

Feature Story: Air Quality and Climate 1
Summary of the Month 1
Climate Forecasts 3

The Air You Breathe and the Climate You Experience

By LAURA EDWARDS
California Climate Specialist
Western Regional Climate Center

California has been a leader in efforts to improve air quality in the United States. The state legislature has taken many measures over the last several decades to reduce the amount harmful emissions from vehicles, homes and businesses. Since 1988, California has studied the implications of a changing climate on the state's environment, economy and water supply, directed by California Energy Commission (CEC) as mandated by AB4420 [1]. A landmark bill was signed by Governor Gray Davis in 2002, AB 1493, to require the California Air Resources Board (CARB) to develop and adopt measures to reduce GHGs emitted by passenger vehicles and light duty trucks. In September 2004, regulations were approved for new motor vehicles beginning with the 2009 model year. The emissions included in these regulations are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydrofluorocarbons (HFCs). (See the CARB website for more details, http://www.arb.ca.gov/cc/cc.htm.) On June 1, 2005, Governor Arnold Schwarzenegger announced an Executive Order that set emission targets for the next half century and designated coordina-

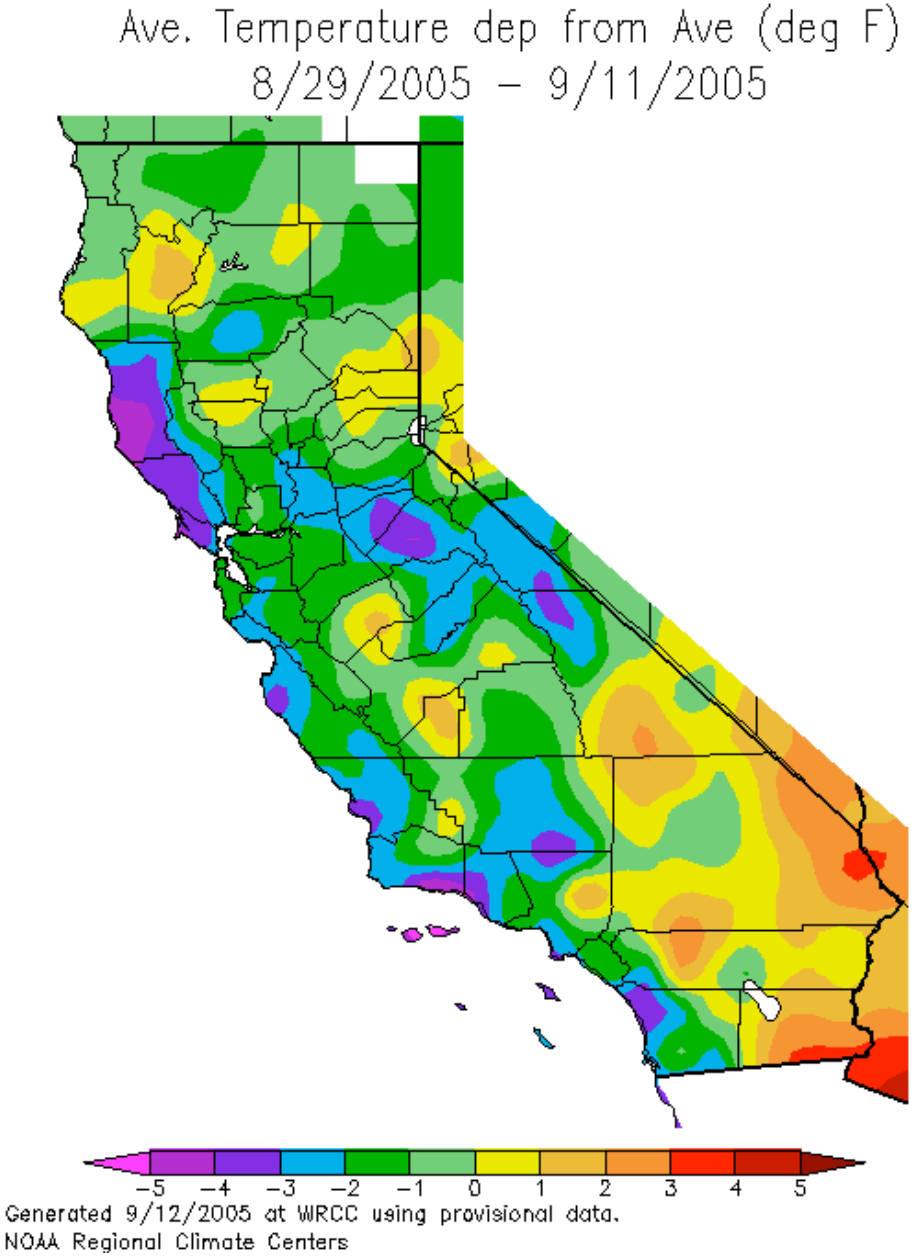
Figure 1. Smog over Los Angeles, 2004.
http://www.usatoday.com/news/nation/2004-09-26-calsmog-usat_x.htm

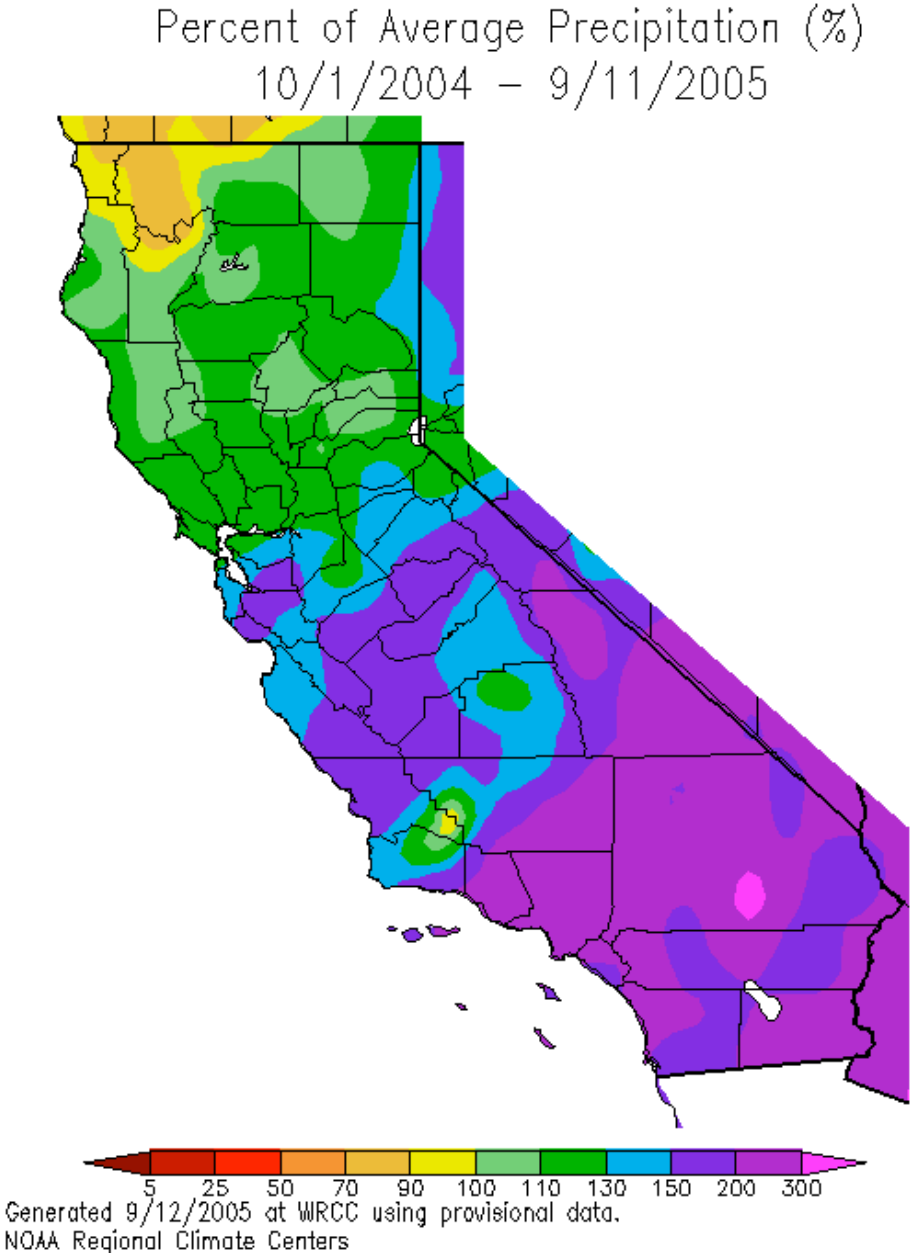
reduced to 2000 levels by 2010, 1990 levels by 2020 and a reduction to 80% of 1990 levels by 2050.

The science behind the Order includes some important concepts. Greenhouse gas (GHG) reduction is important to improving air quality, but this action also has impacts on climate. GHGs absorb infrared energy that is radiated or reflected from the surface. As these gases absorb this energy, it heats the air around it, which occurs on a global scale with increased GHGs worldwide.

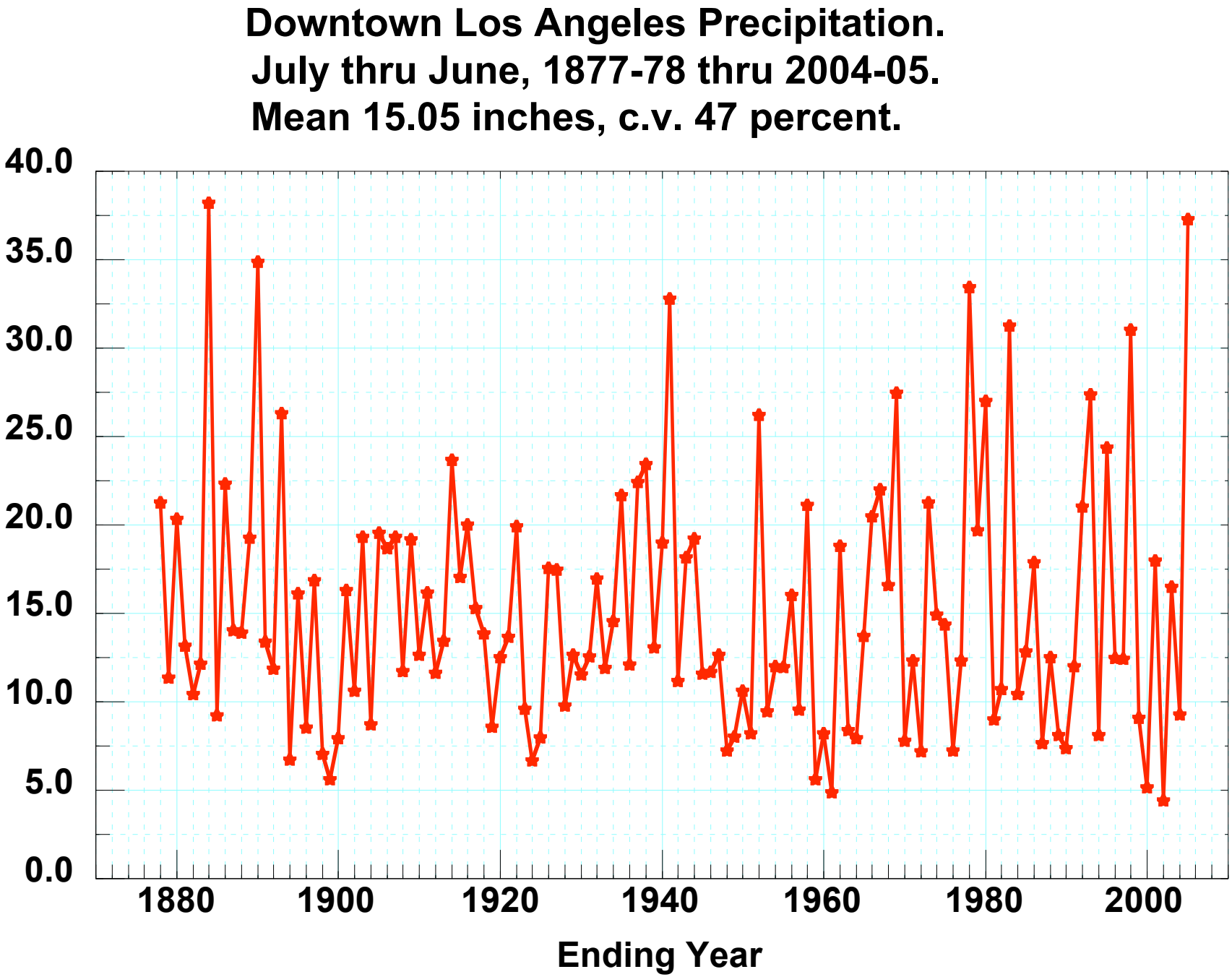
There is some natural amount of GHGs in the atmosphere which makes the planet habitable, but human activities have increased the abundance of these gases, including carbon dioxide and methane beyond the natural level.

Other pollutants such as nitrous oxide, ozone (O_3) and particulate matter or aerosols, also impact air quality, human health, agriculture, and climate. Ozone is healthy at the highest levels of our atmosphere, providing a beneficial block to some ultraviolet radiation, but is harmful at low levels, in the troposphere where we live. Tropospheric ozone is estimated to be the third largest

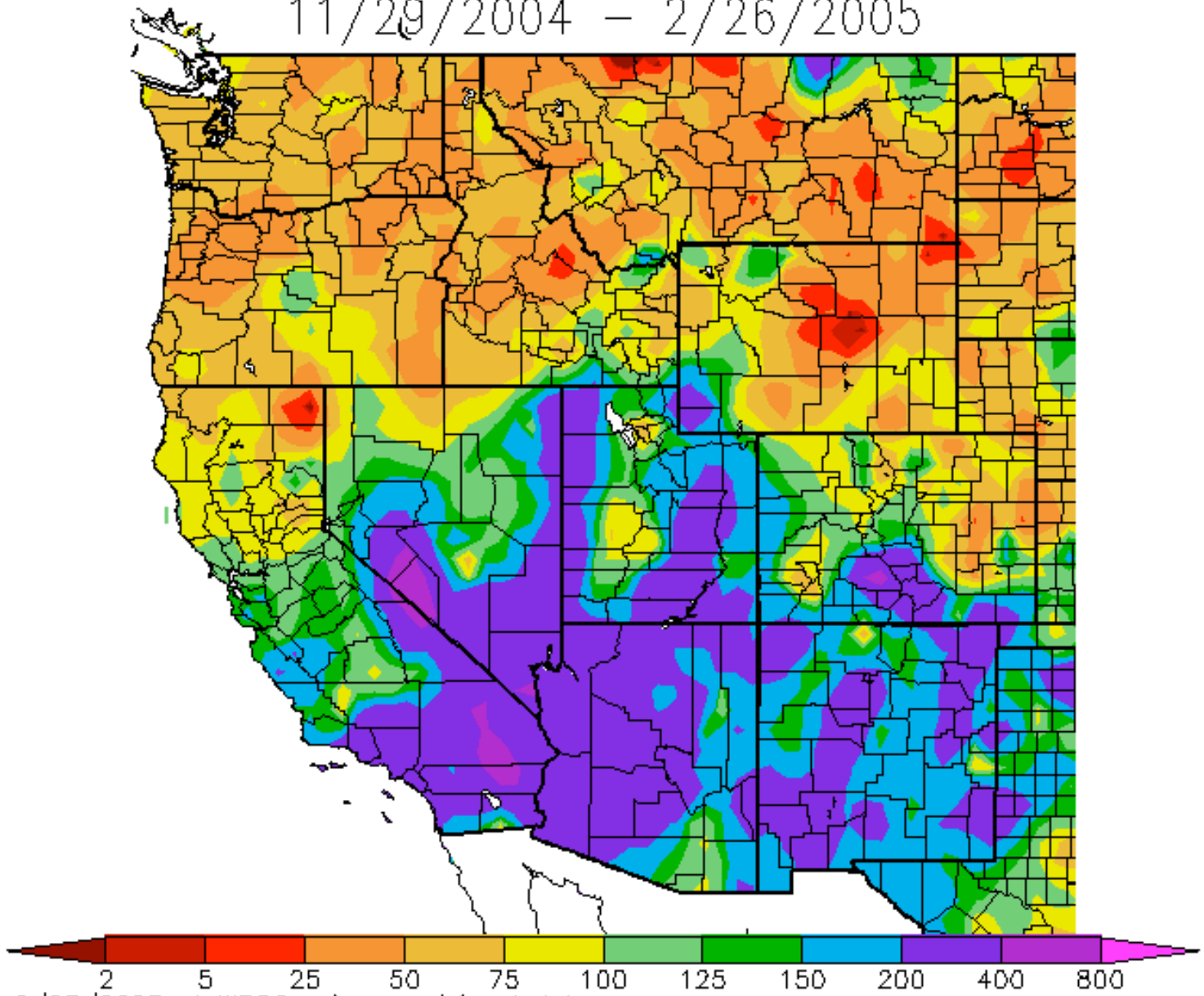




Approximately 650 maps for California, updated daily.


Downtown Los Angeles Precipitation.
July thru June, 1877-78 thru 2004-05.
Mean 15.05 inches, c.v. 47 percent.
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1880
1900
1920
1940
1960
1980
2000
Ending Year

Percent of Average Precipitation (%)
11/29/2004 – 2/26/2005

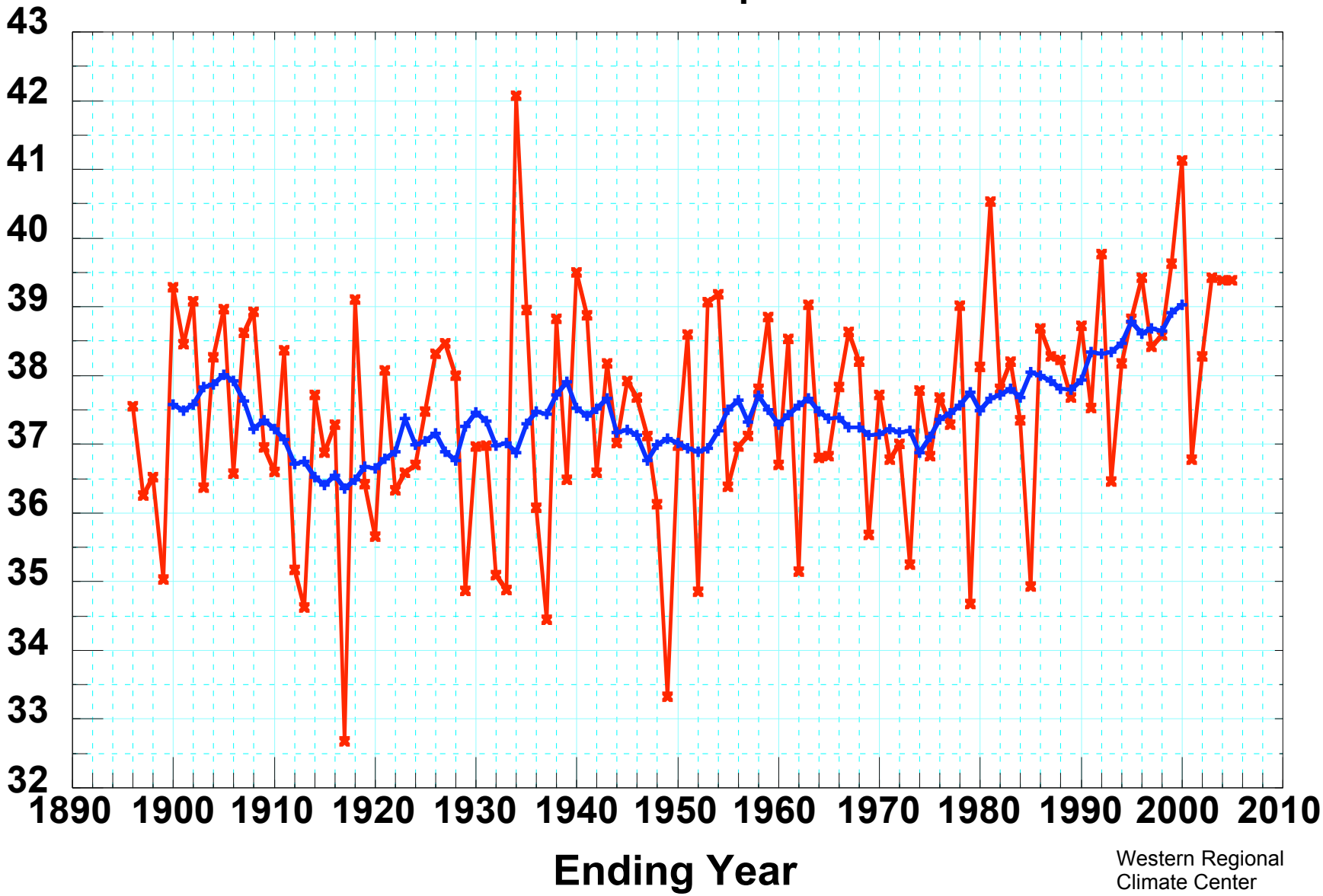


Generated 2/27/2005 at WRCC using provisional data.
NOAA Regional Climate Centers

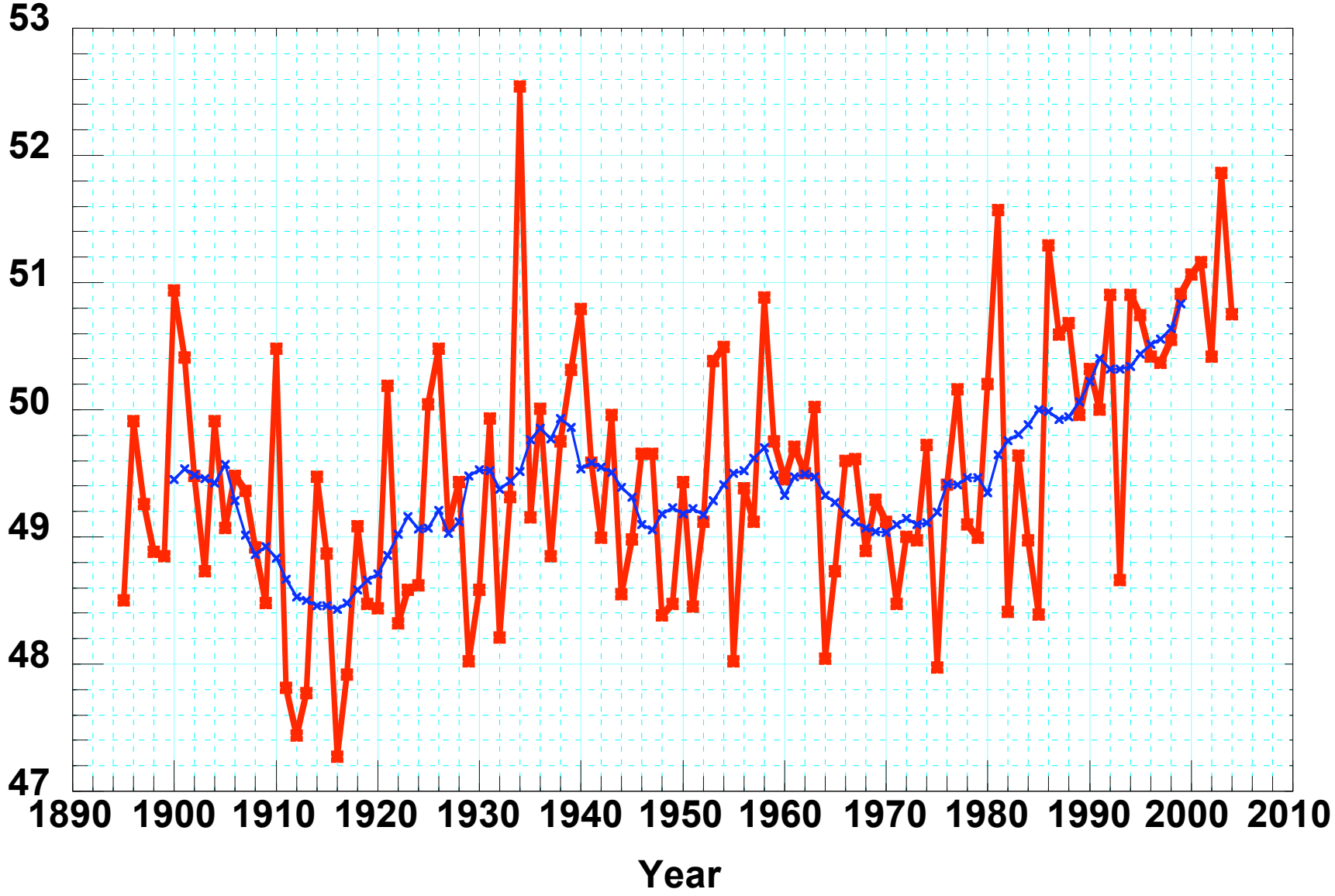
Western United States (11 states) Winter Temperature (October-March)

Provisional data from NCDC / CPC. 11-year running mean in blue.

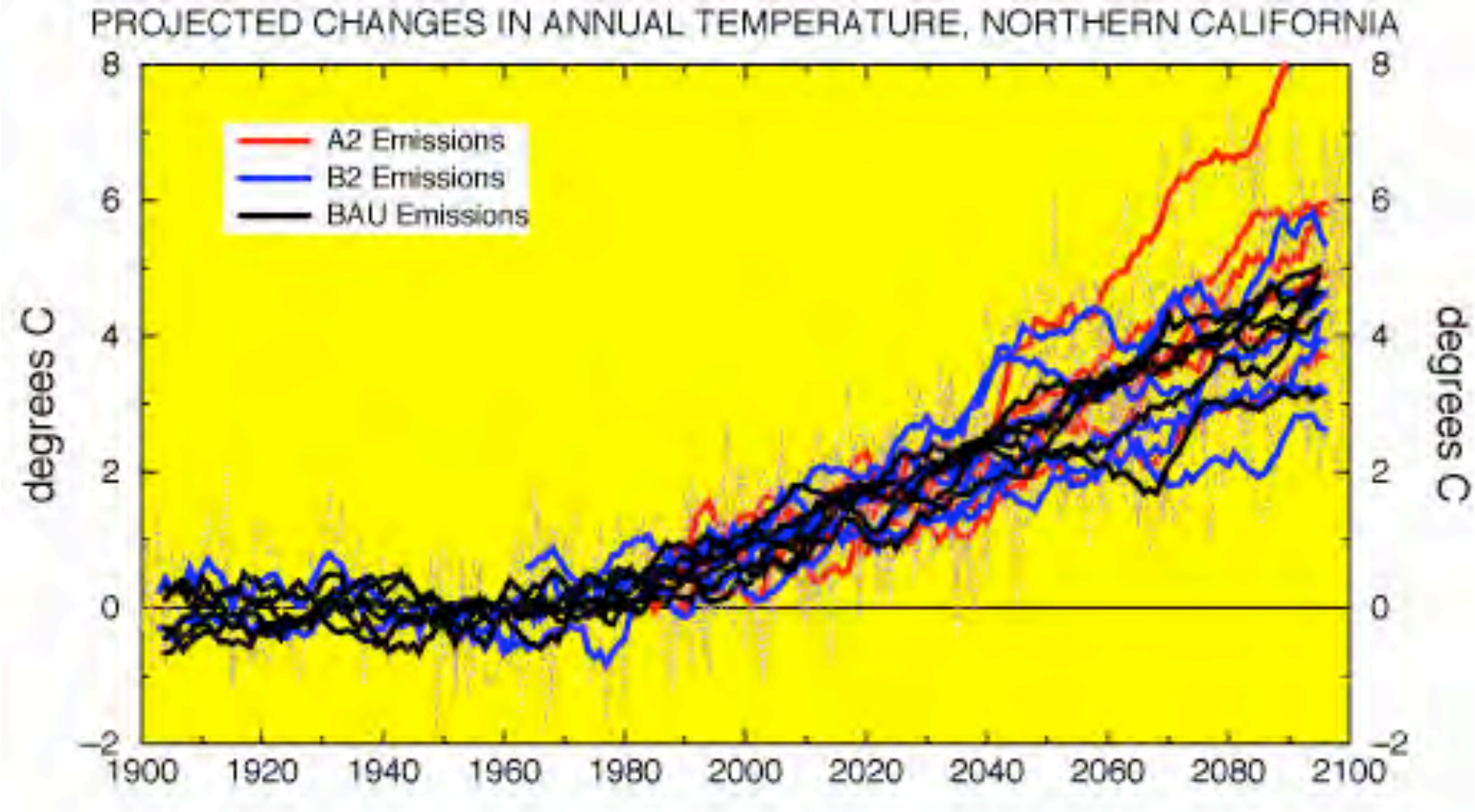
Units: Inches. Data source NOAA cooperative network. Thru 2004-05.



Western Regional
Climate Center

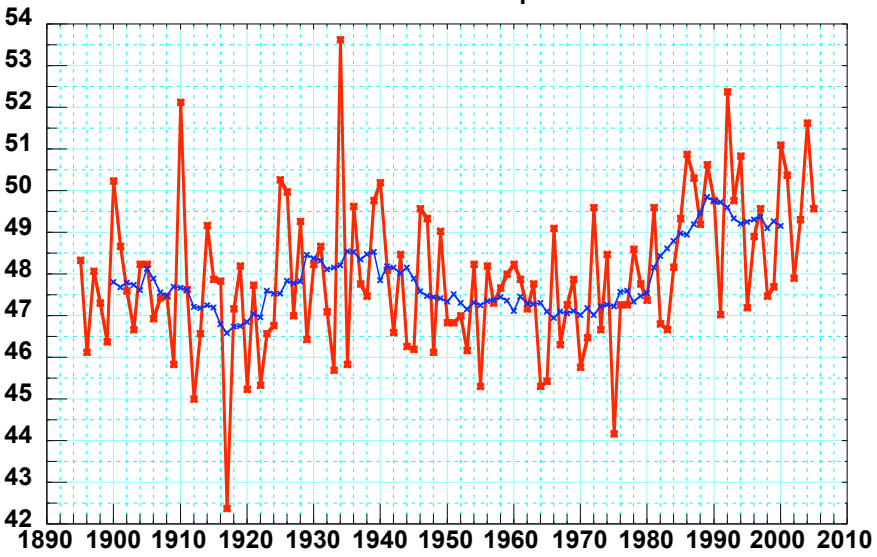

Western United States (11 states) Annual Jan-Dec Temperature
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network, thru May 2005.
53
52
51
50
49
48
47
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year

Courtesy of Mike Dettinger, USGS / Scripps.



Dettinger MD. 2005. From climate change spaghetti to climate-change distributions for 21st Century California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 1, (March 2005), Article 4. http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art4

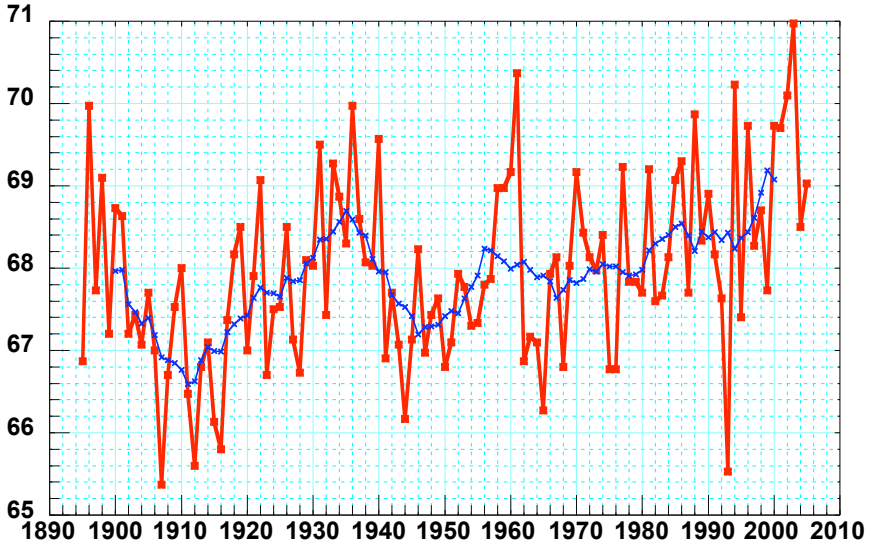
Western United States (11 states) Mar-Apr-May Temperature
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network.



Spring

Western Regional Climate Center

Western United States (11 states) June-July-August Temperature
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network, thru Aug 2005.

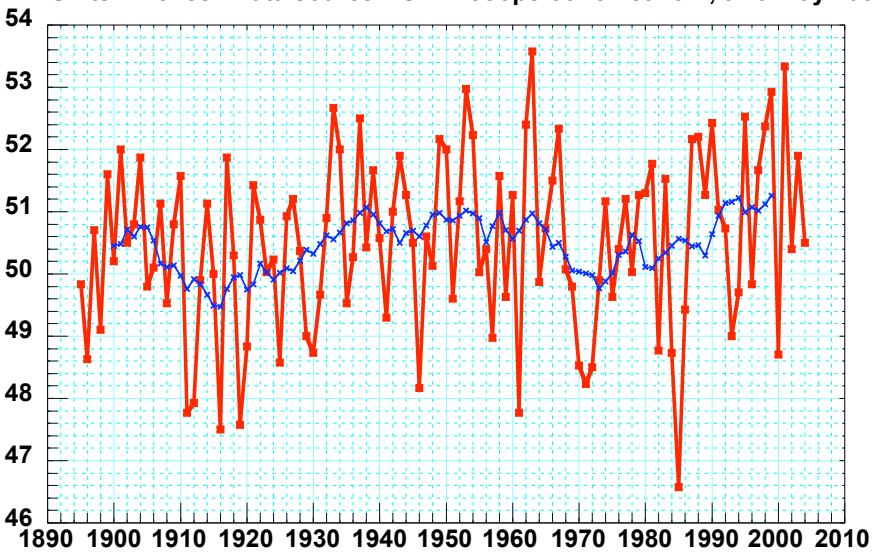


Temperature

Summer

Western Regional Climate Center

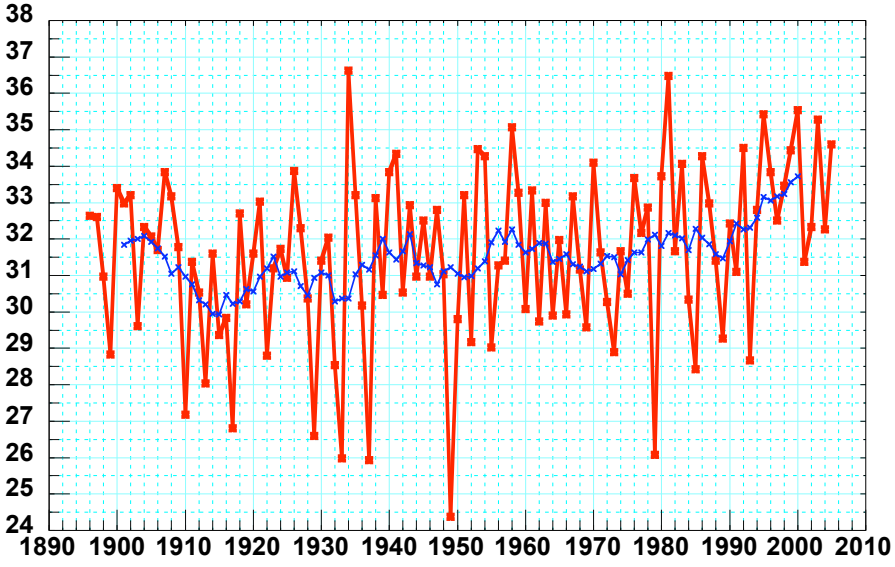
Western United States (11 states) Sept-Oct-Nov Temperature
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network, thru May 2005.



Autumn

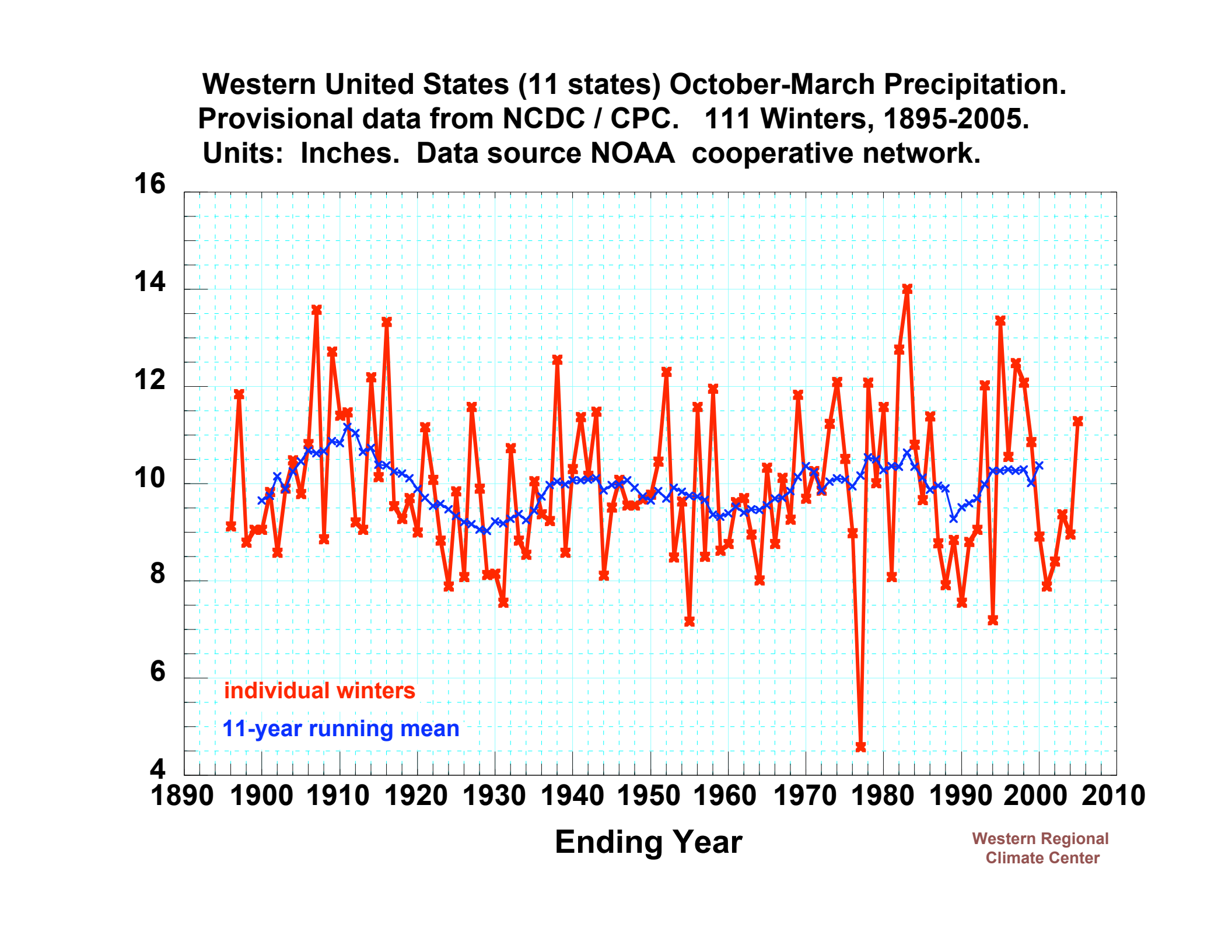
Western Regional Climate Center

Western United States (11 states) Dec-Jan-Feb Temperature
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network, thru May 2005.

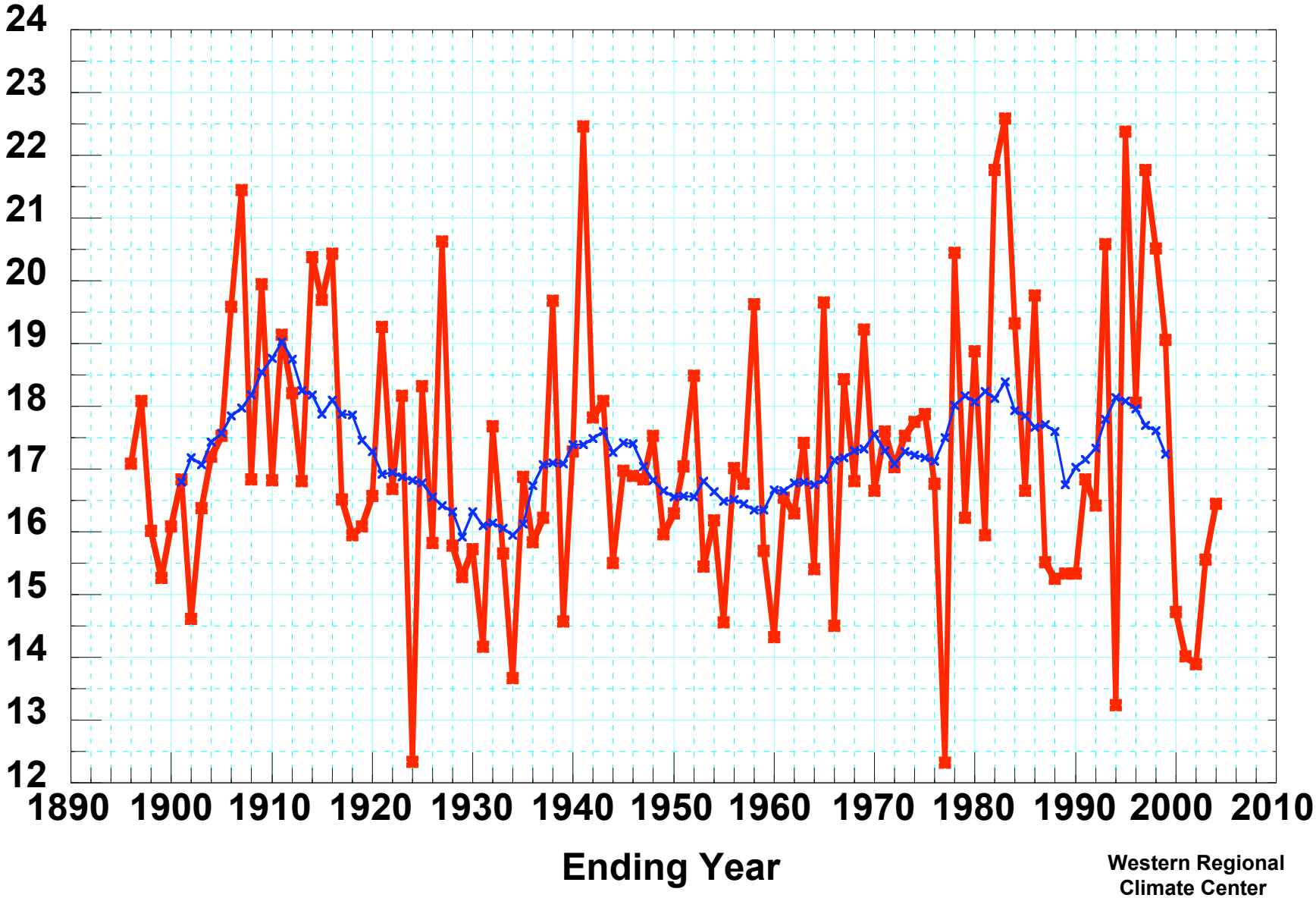


Winter

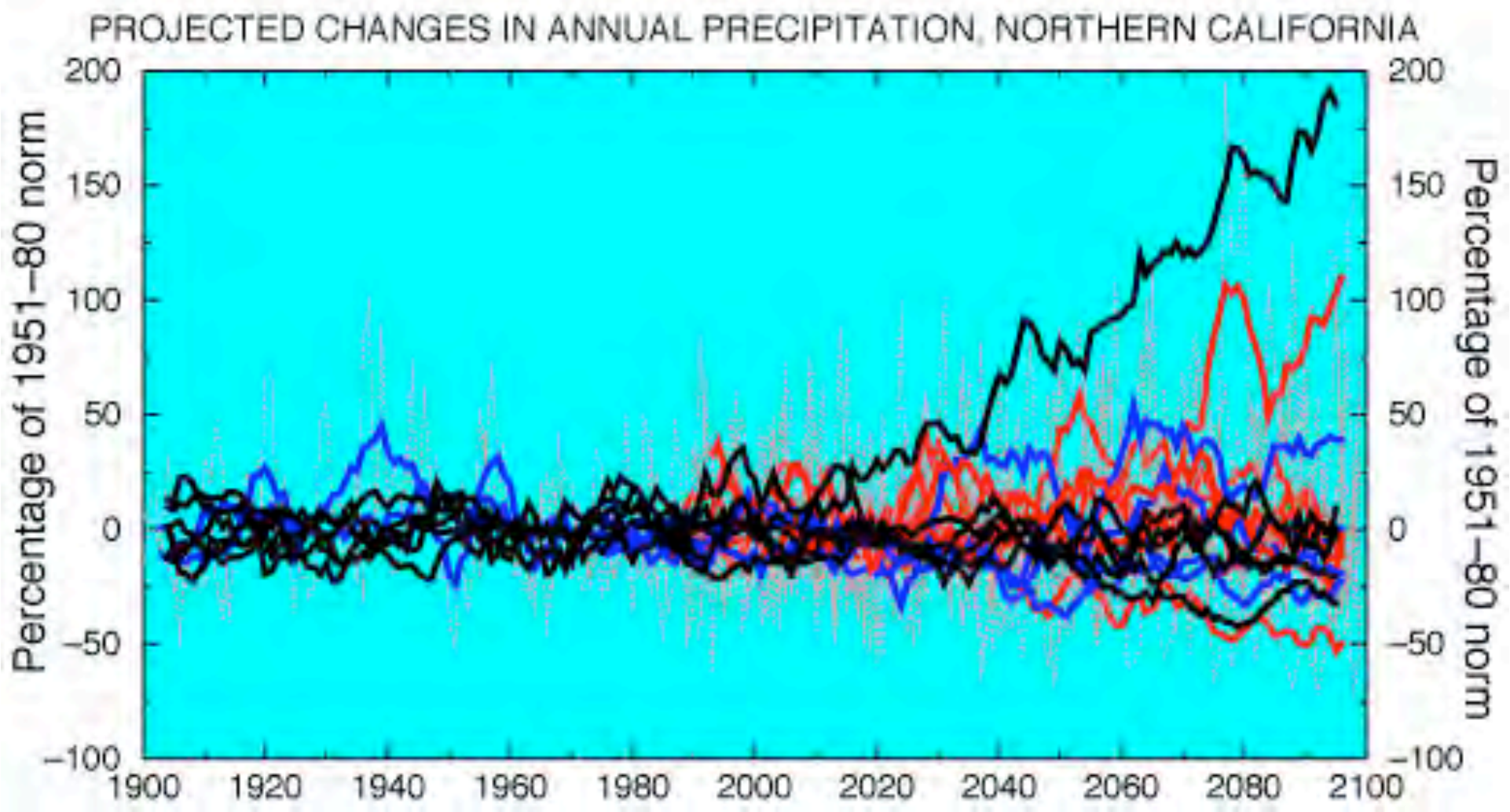
Western Regional Climate Center


Western United States (11 states) October-March Precipitation.
Provisional data from NCDC / CPC. 111 Winters, 1895-2005.
Units: Inches. Data source NOAA cooperative network.
16
14
12
10
8
6
4
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
individual winters
11-year running mean
Ending Year
Western Regional
Climate Center

Western United States (11 states) Water Year (Oct-Sep) Precipitation.
Provisional data from NCDC / CPC. Blue: 11-year running mean.
Units: Inches. Data source NOAA cooperative network, thru May 2005.



Courtesy of Mike Dettinger, USGS / Scripps.



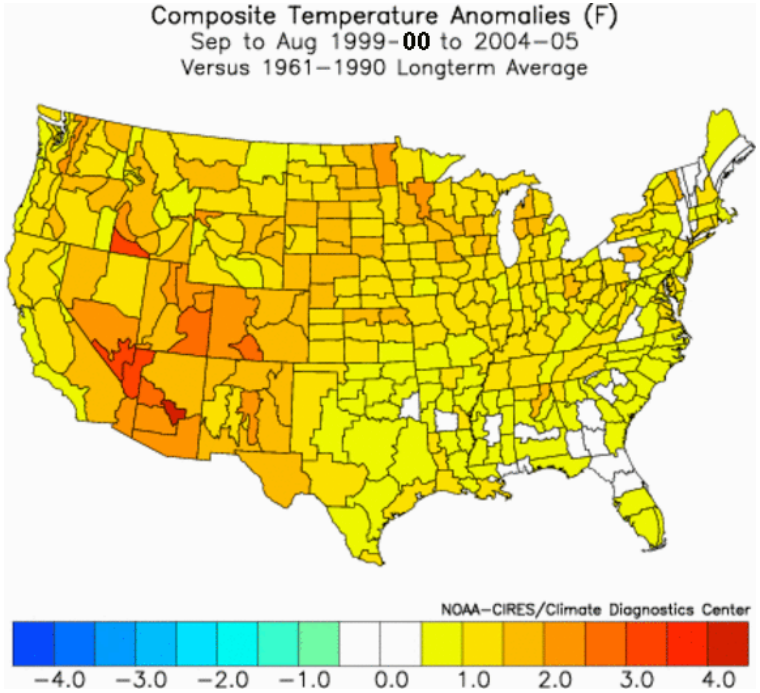
Dettinger MD. 2005. From climate change spaghetti to climate-change distributions for 21st Century California. San Francisco Estuary and Watershed Science. Vol. 3, Issue 1, (March 2005), Article 4. http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art4

Last six years

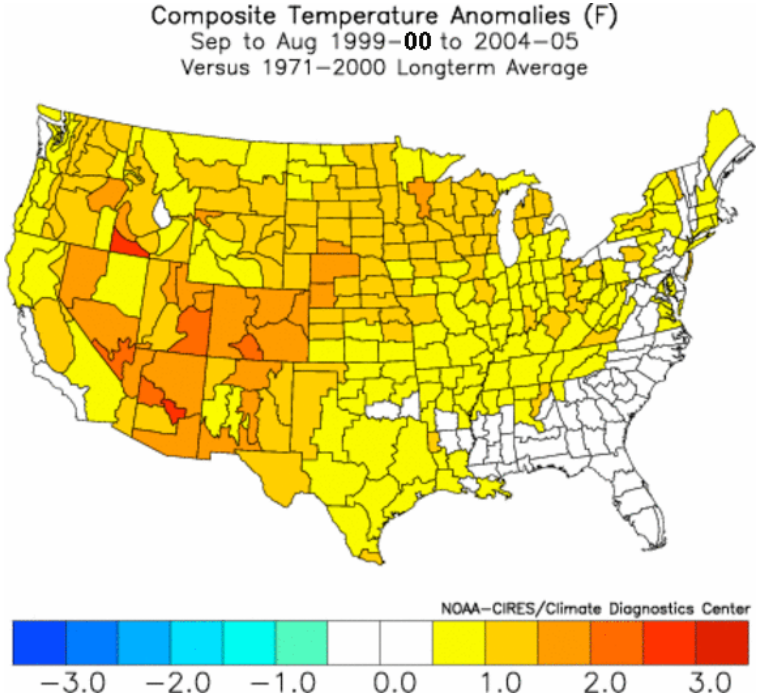
Sep-Aug Temperature

1999-00 / 2004-05

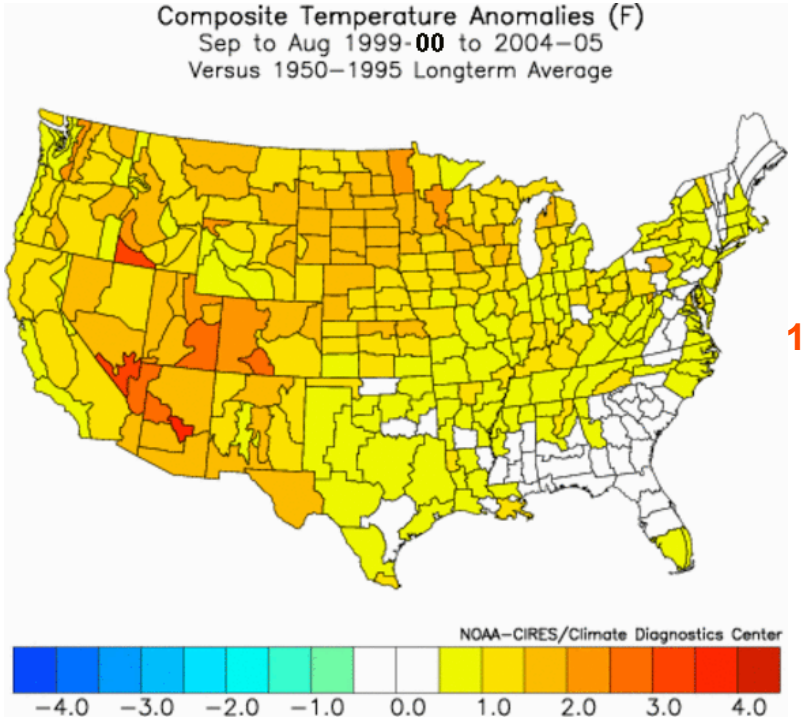
Departure (F) from



1961-1990

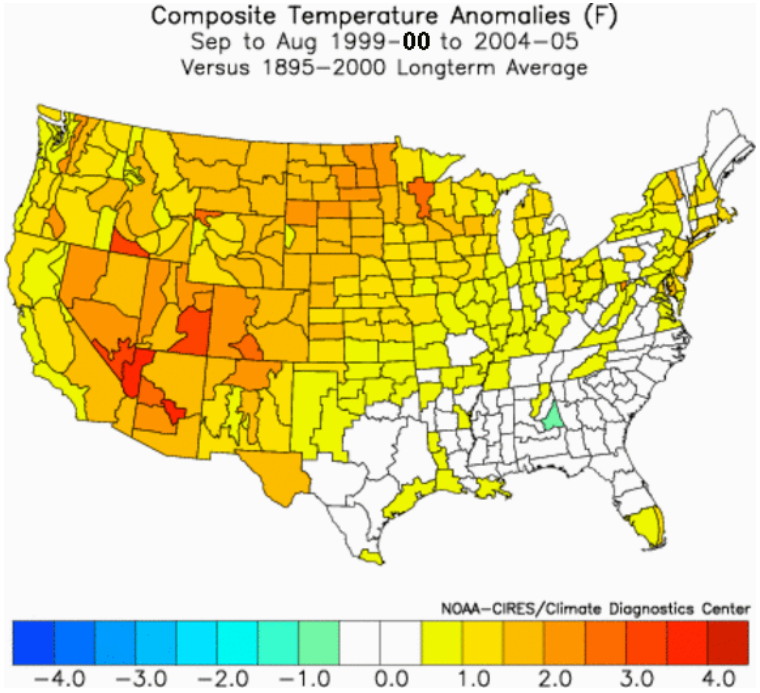


1971-2000

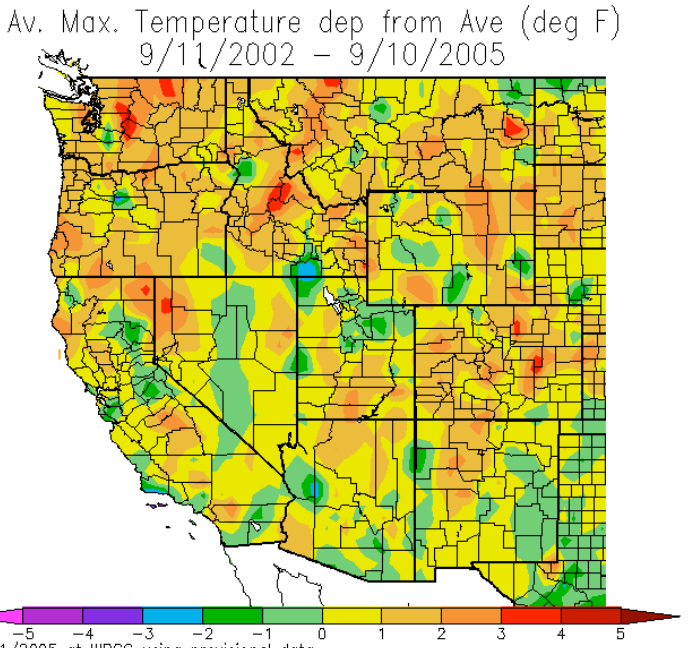


1950-1995

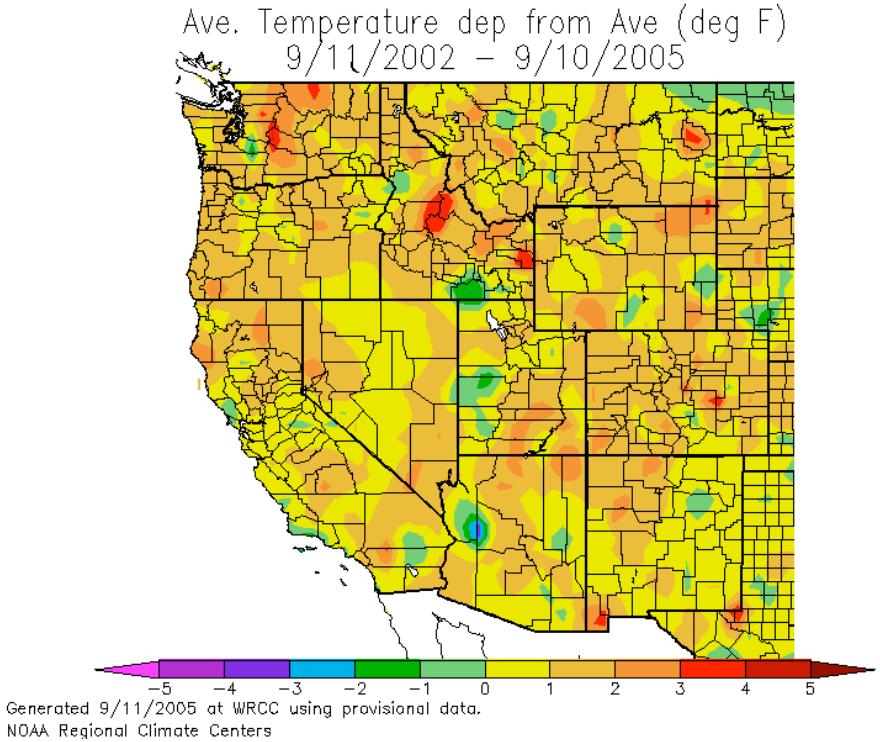
1895-2000



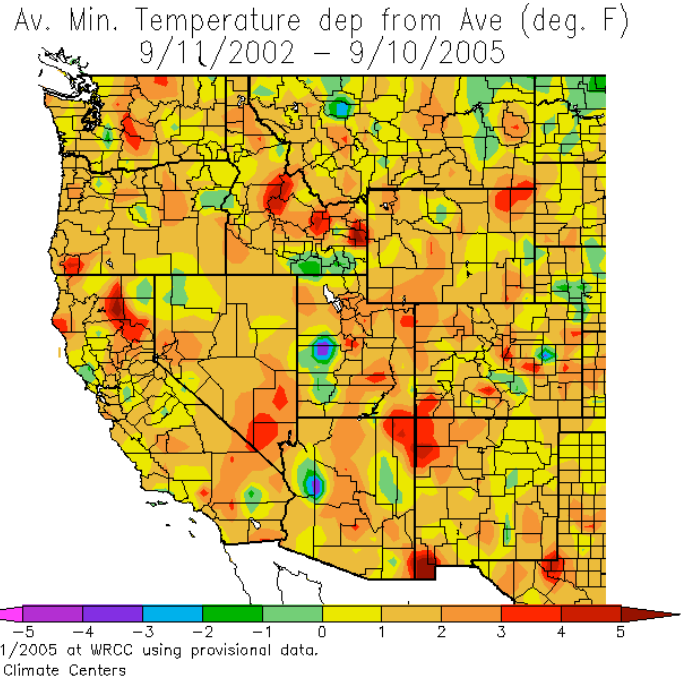
Maximum Temperature Departure from Average Past Three Years

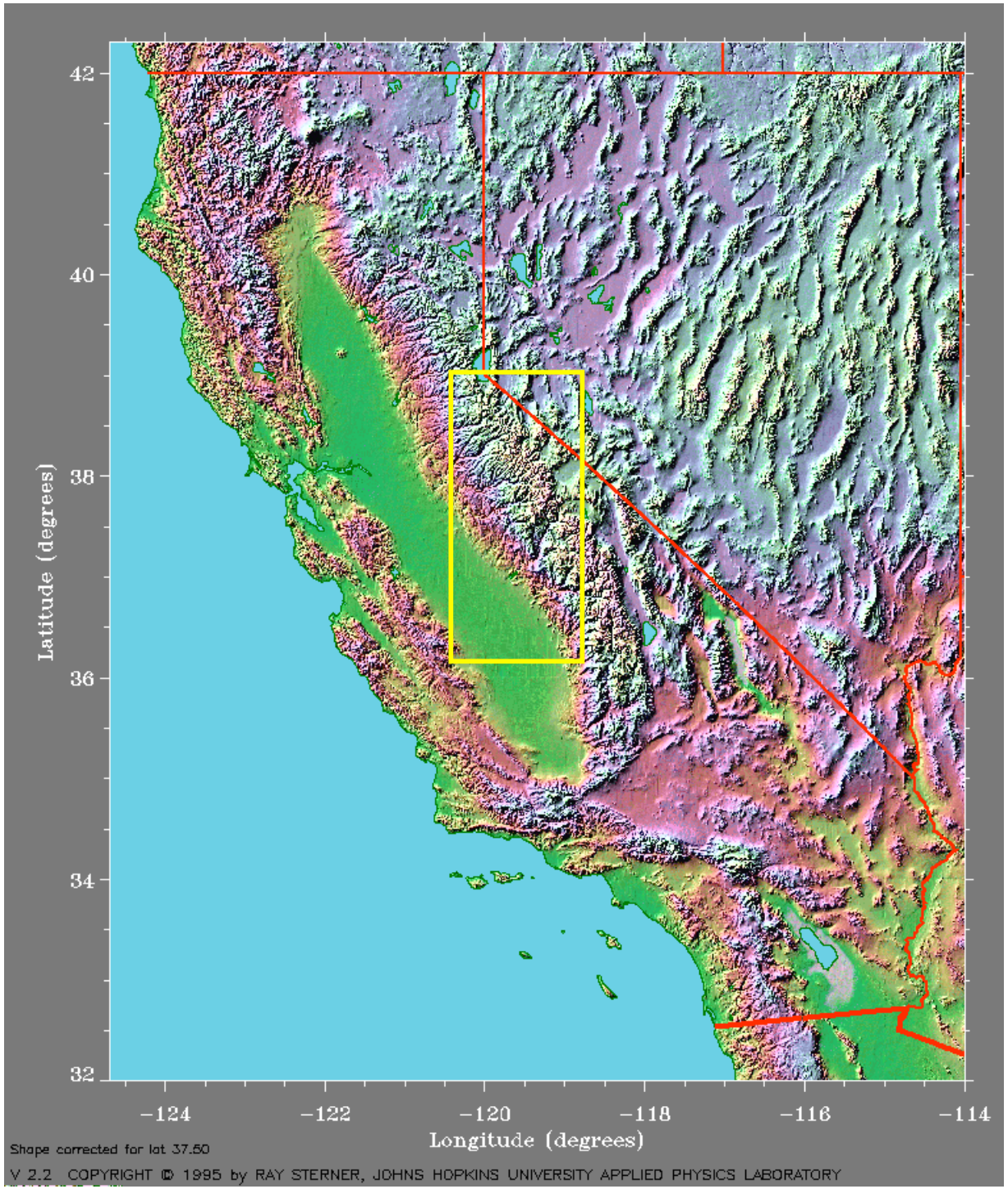


Mean Temperature Departure from Average Past Three Years



Minimum Temperature Departure from Average Past Three Years





Grids.

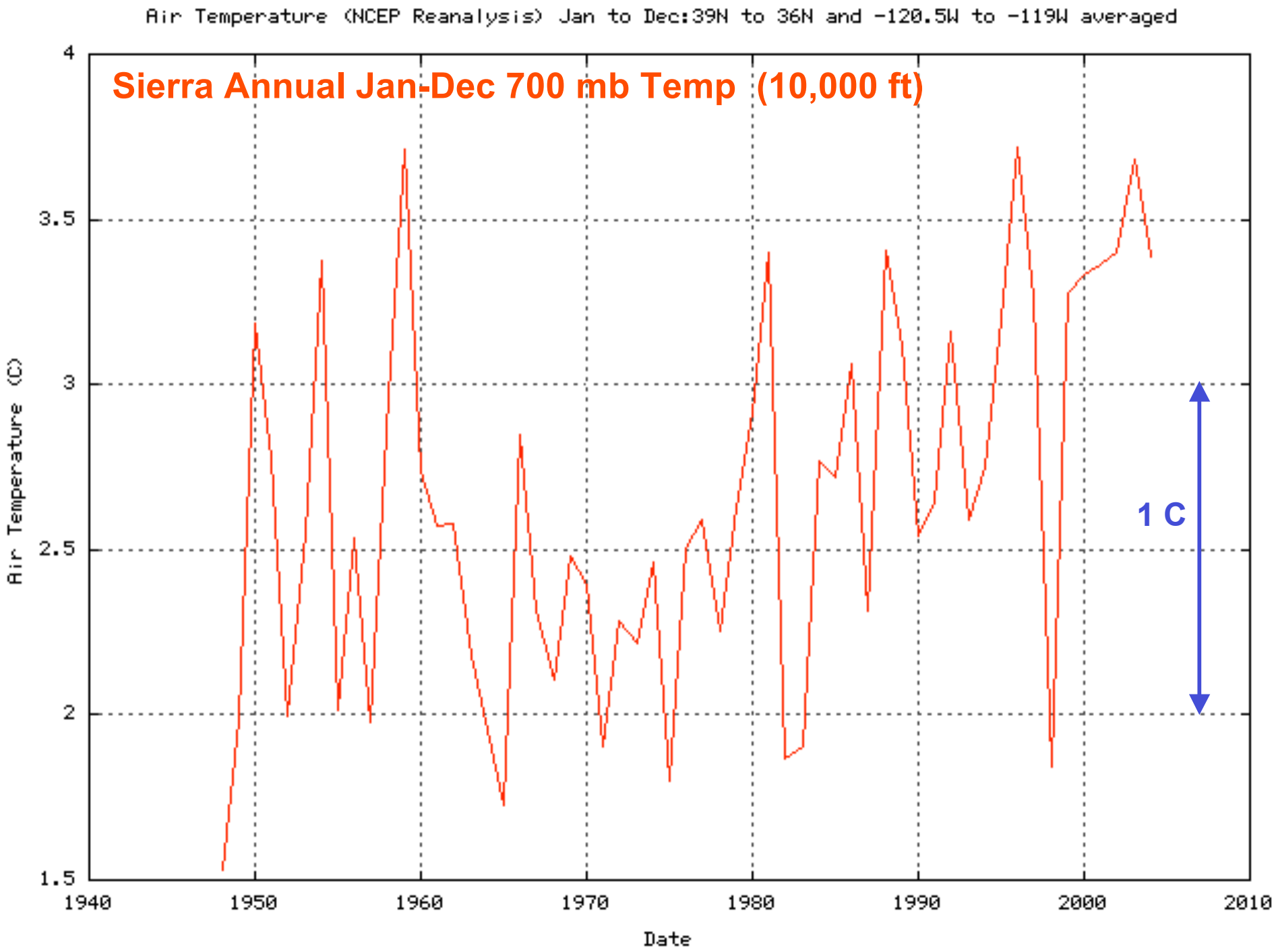
Reanalysis Resolution:

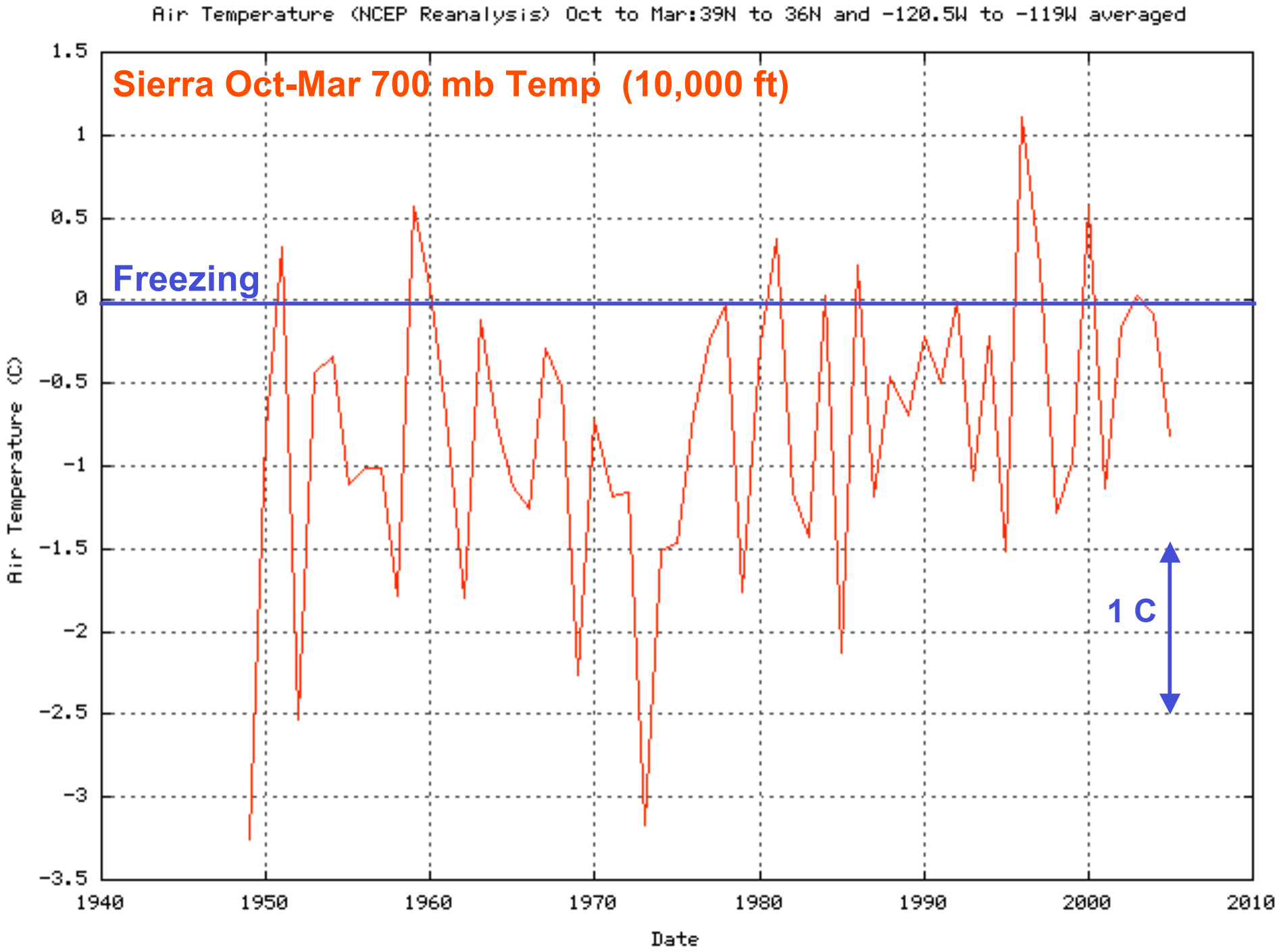
Global

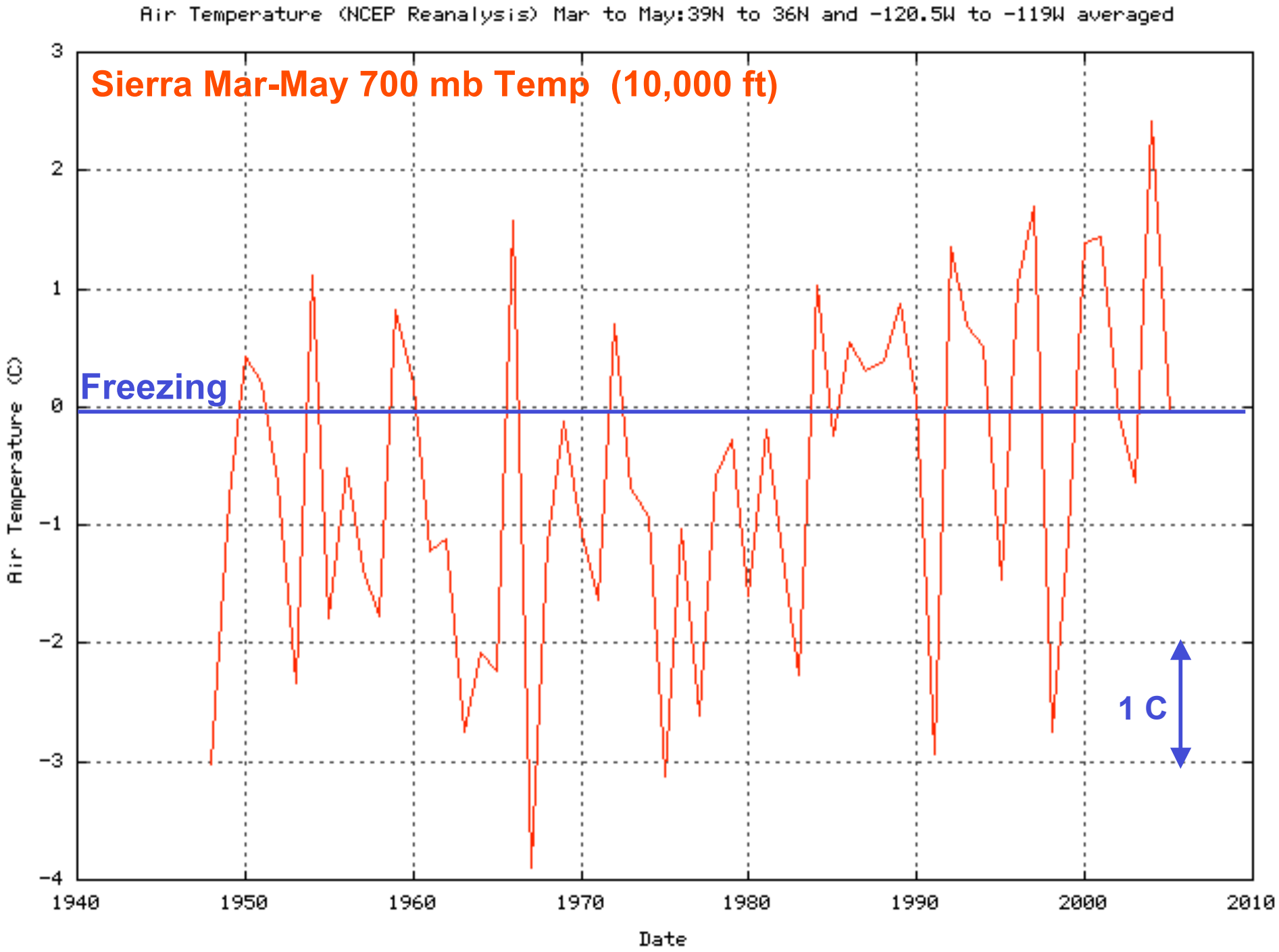
Regional (slightly smaller; pixel resolution)

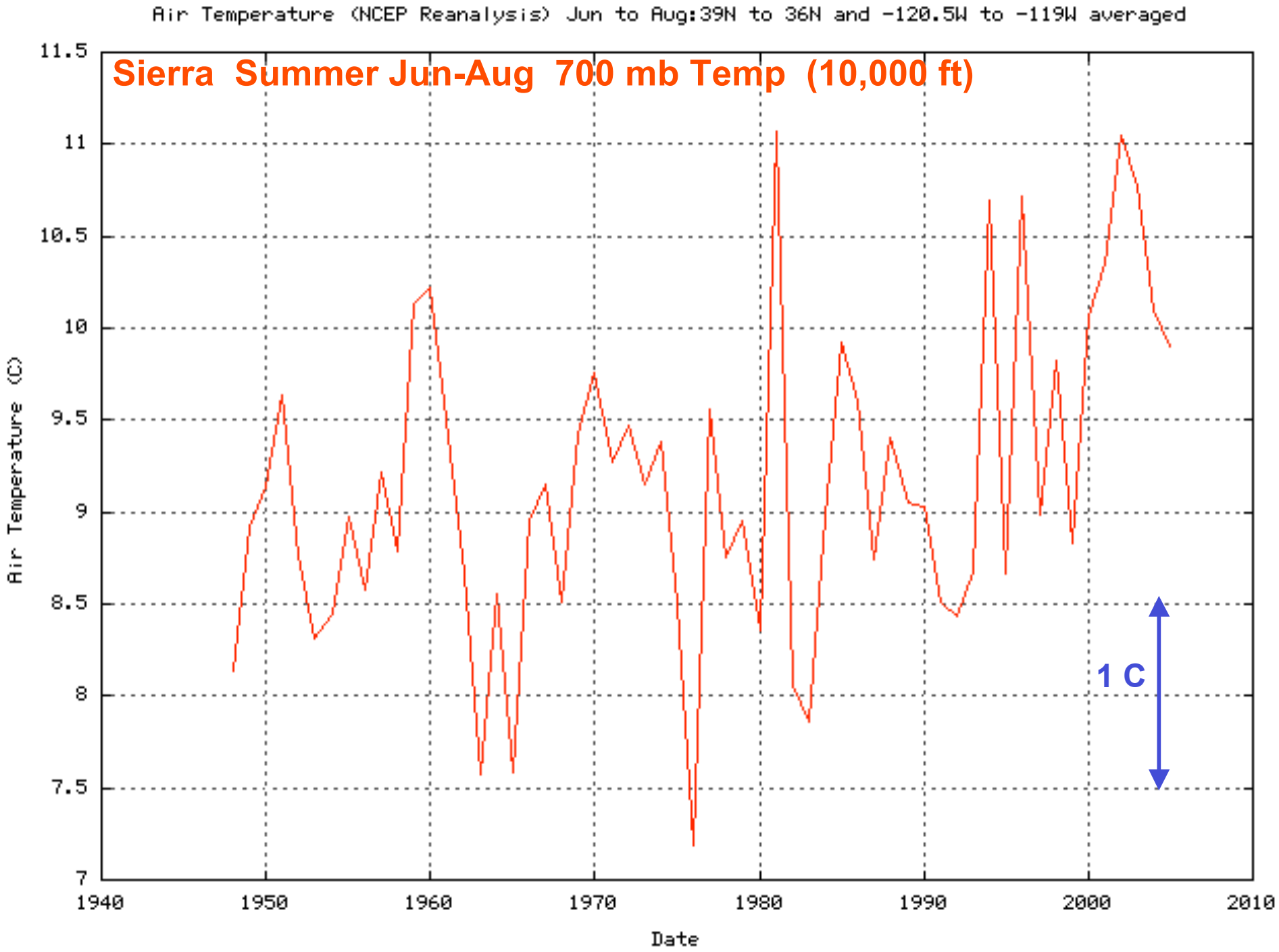
Desired Resolution

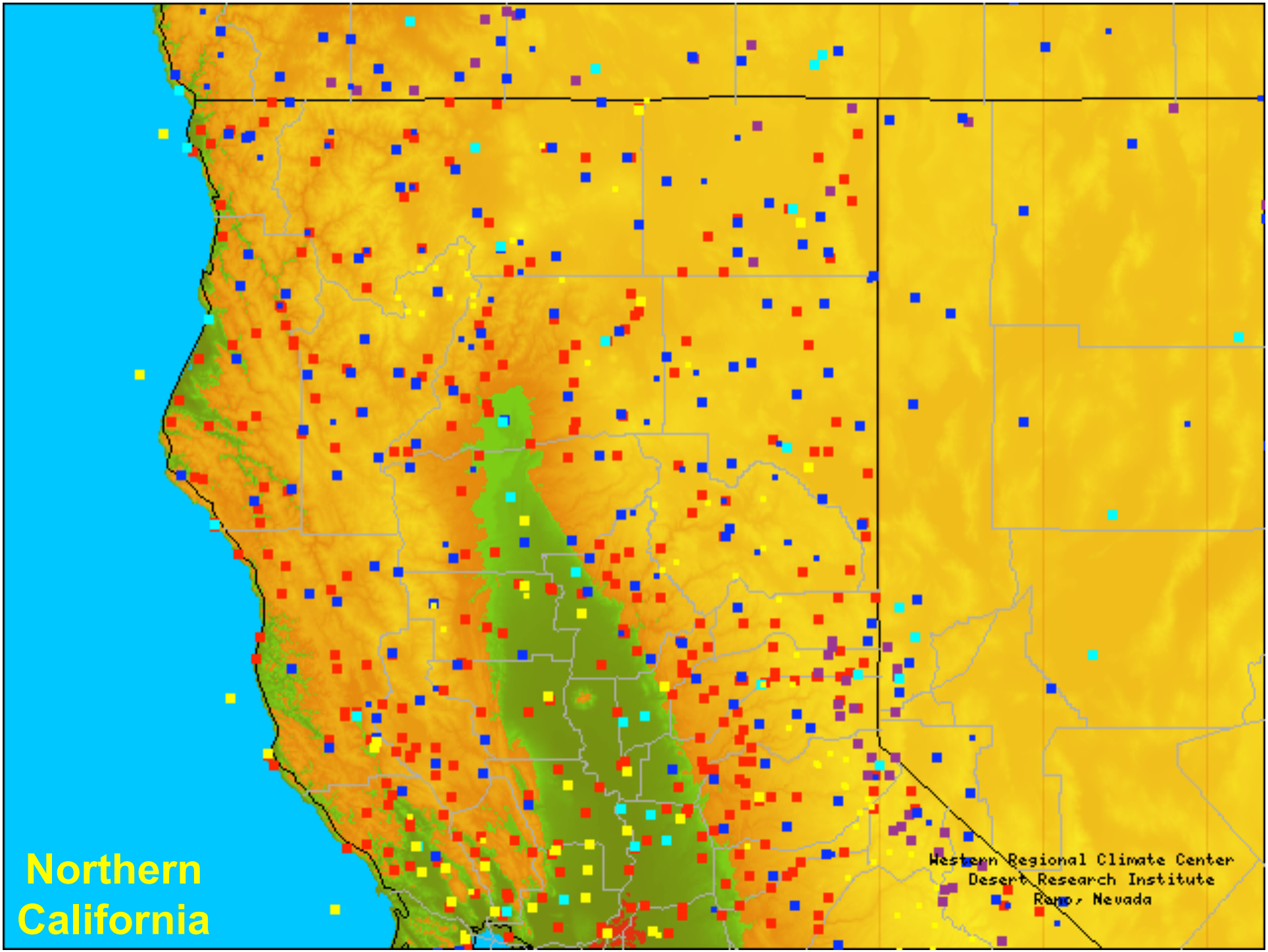
About 1 km

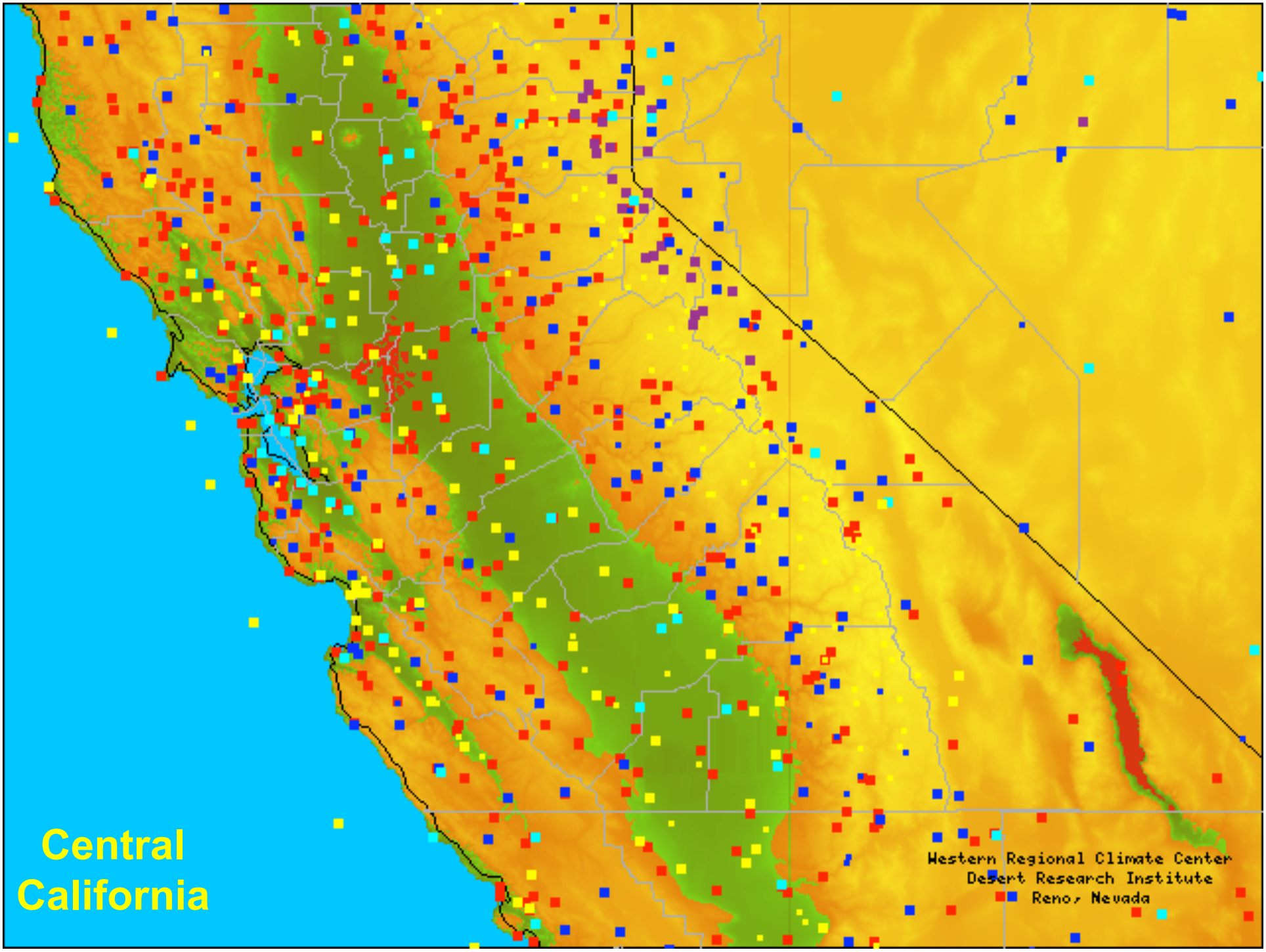

Air Temperature (NCEP Reanalysis) Jan to Dec:39N to 36N and -120.5W to -119W averaged
Sierra Annual Jan-Dec 700 mb Temp (10,000 ft)
Air Temperature (C)
4
3.5
3
2.5
2
1.5
1940
1950
1960
1970
1980
1990
2000
2010
Date
1 C

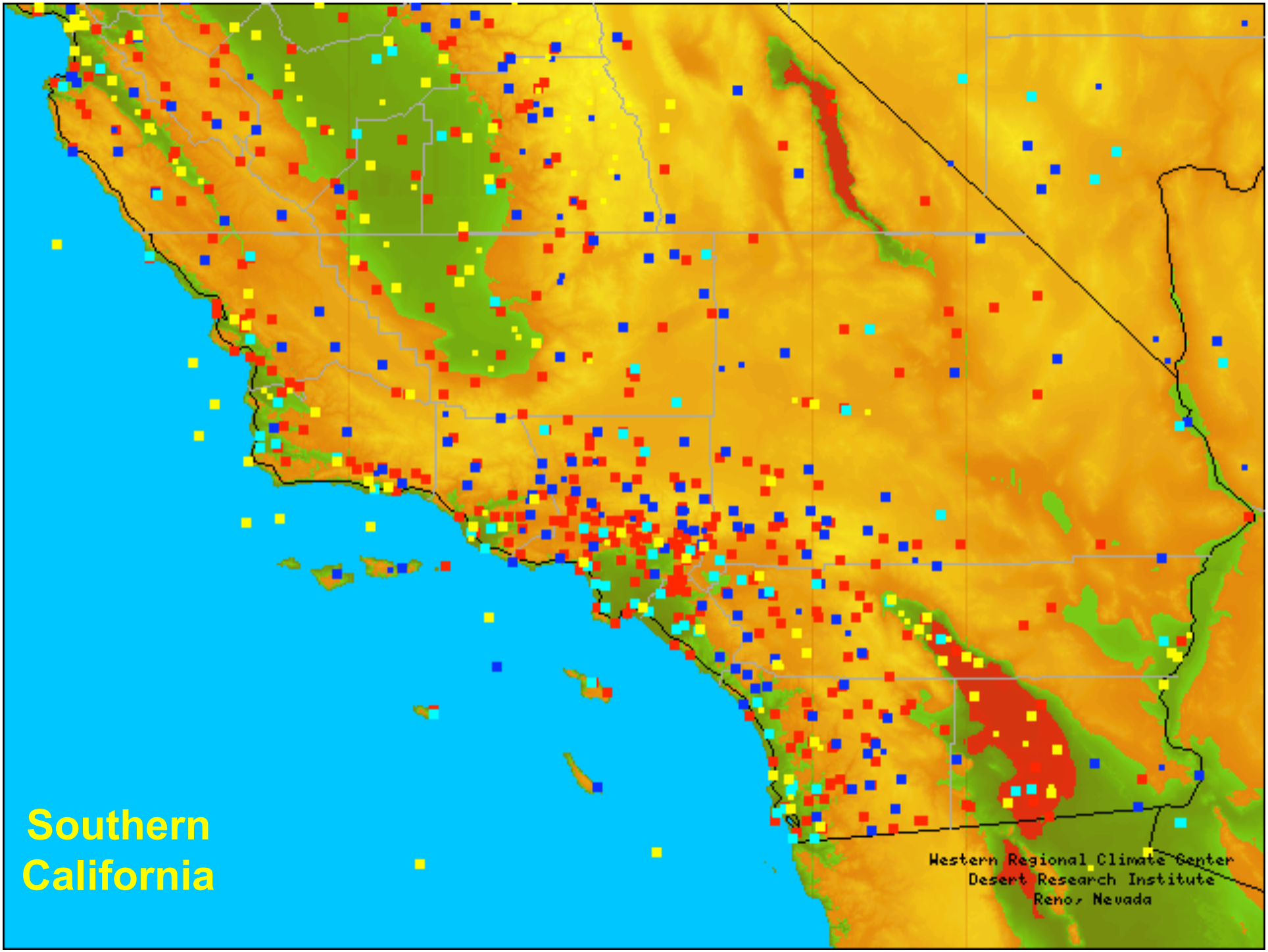

Air Temperature (NCEP Reanalysis) Oct to Mar:39N to 36N and -120.5W to -119W averaged
Sierra Oct-Mar 700 mb Temp (10,000 ft)
Freezing
1 C
Air Temperature (C)
Date
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
1940
1950
1960
1970
1980
1990
2000
2010


Air Temperature (NCEP Reanalysis) Mar to May:39N to 36N and -120.5W to -119W averaged
Sierra Mar-May 700 mb Temp (10,000 ft)
Freezing
1 C
Air Temperature (C)
Date
3
2
1
0
-1
-2
-3
-4
1940
1950
1960
1970
1980
1990
2000
2010

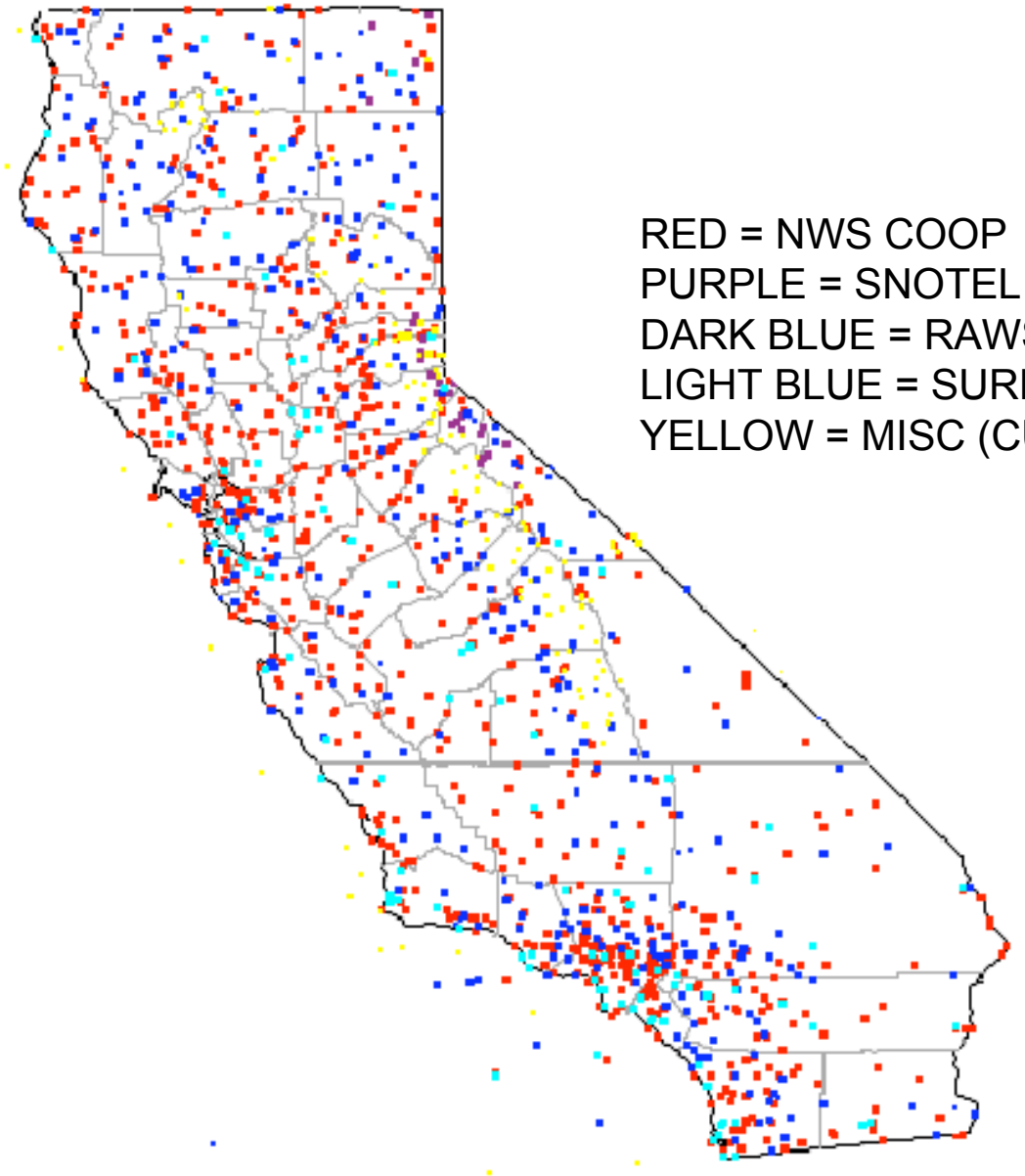

Air Temperature (NCEP Reanalysis) Jun to Aug:39N to 36N and -120.5W to -119W averaged
Sierra Summer Jun-Aug 700 mb Temp (10,000 ft)
Air Temperature (C)
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
1940
1950
1960
1970
1980
1990
2000
2010
Date
1 C


Northern
California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada

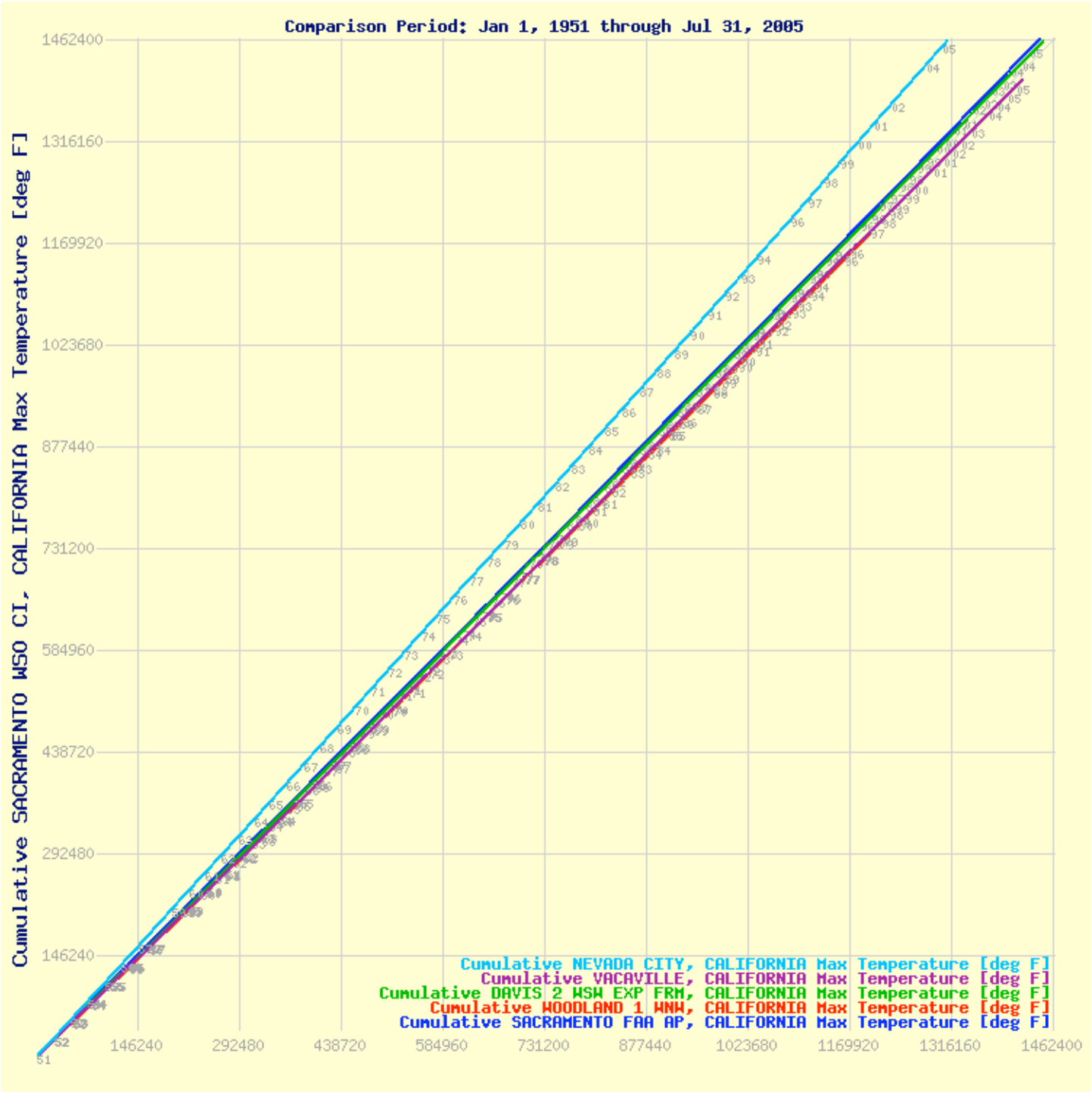

Central
California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada


Southern
California
Western Regional Climate Center
Desert Research Institute
Reno, Nevada

Current Stations



RED = NWS COOP
PURPLE = SNOTEL
DARK BLUE = RAWS
LIGHT BLUE = SURFACE AIRWAYS
YELLOW = MISC (CURRENTLY CIMIS, CDEC, BUOYS)

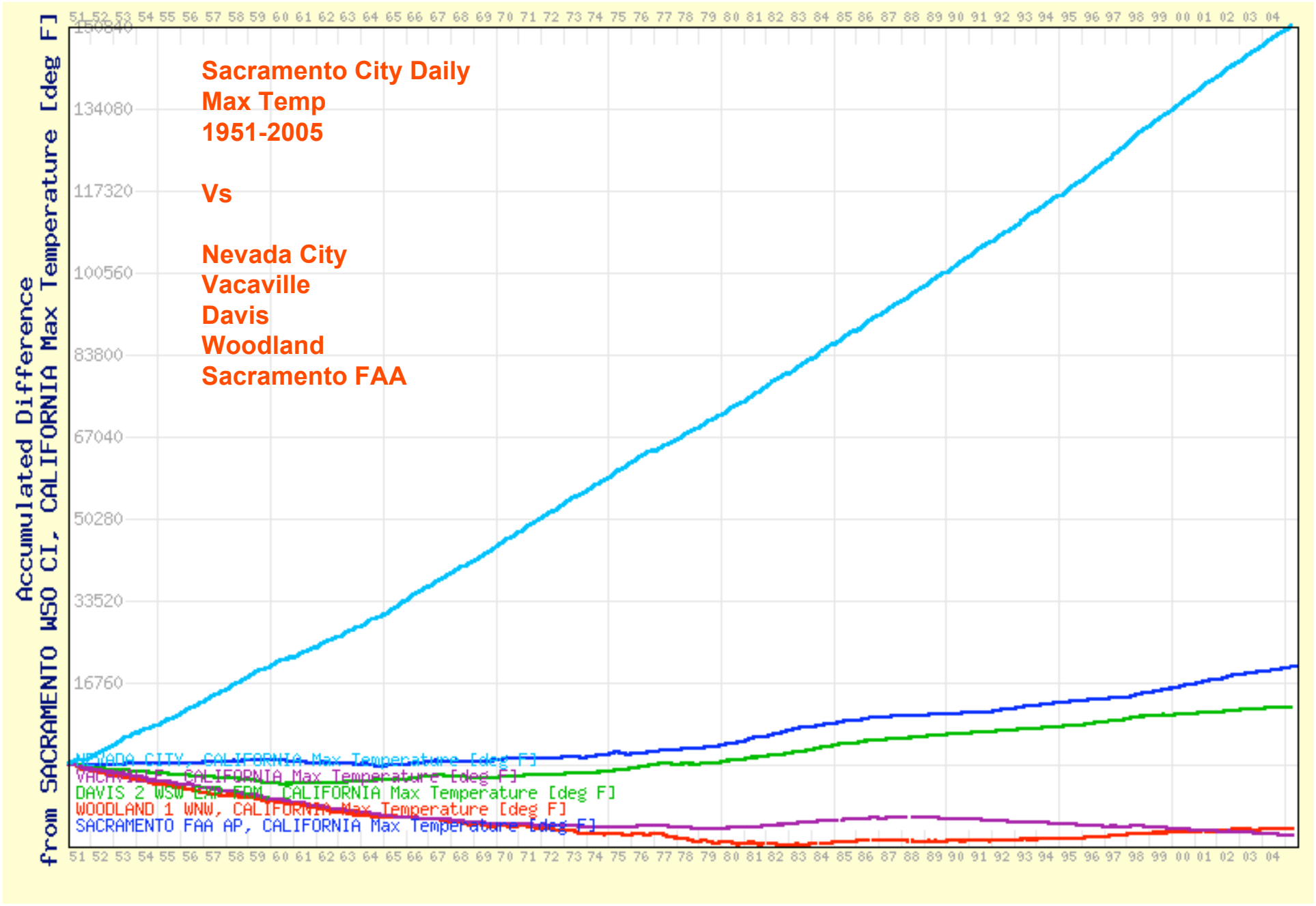


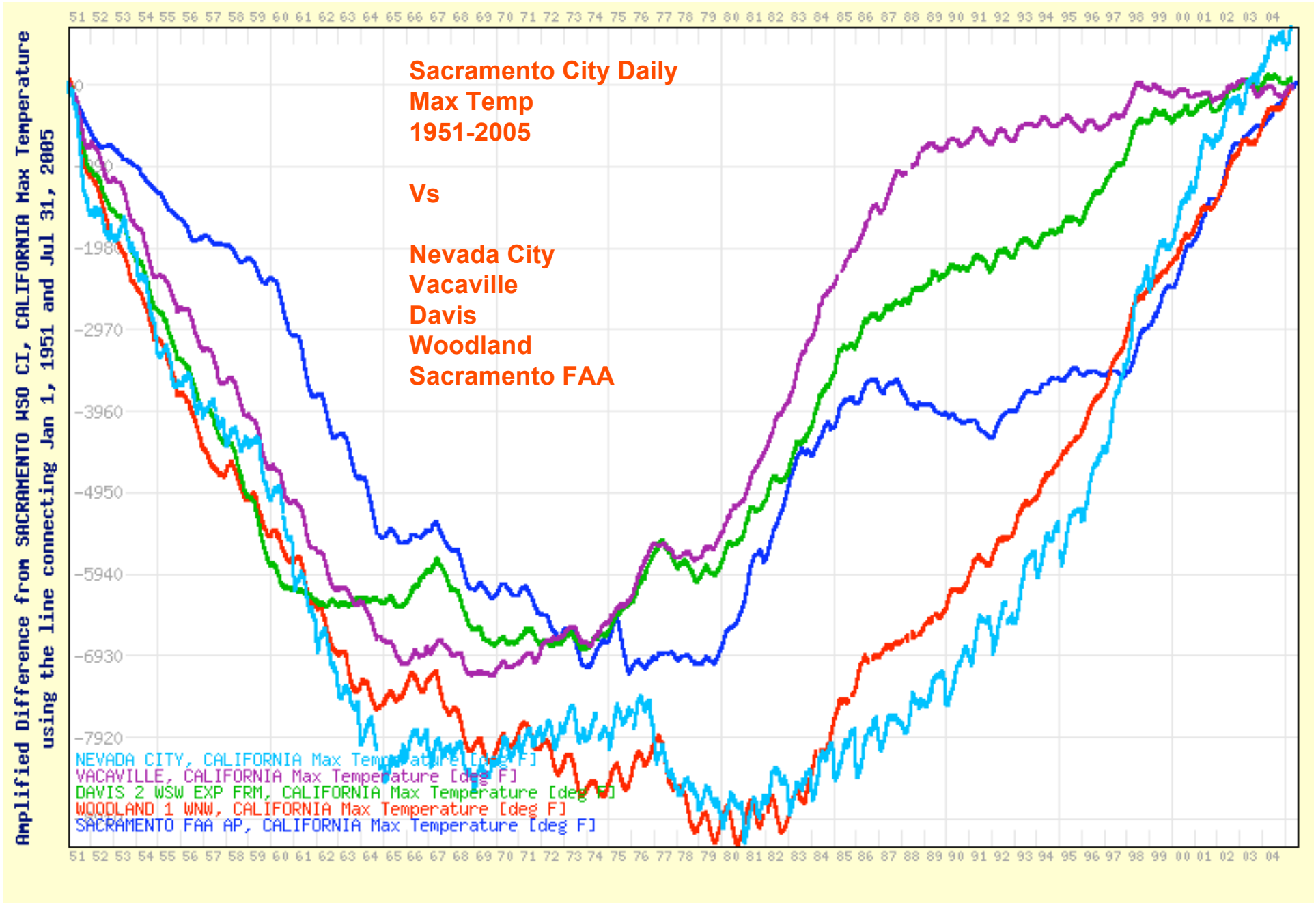
Sacramento City
Daily Max Temp
1951-2005

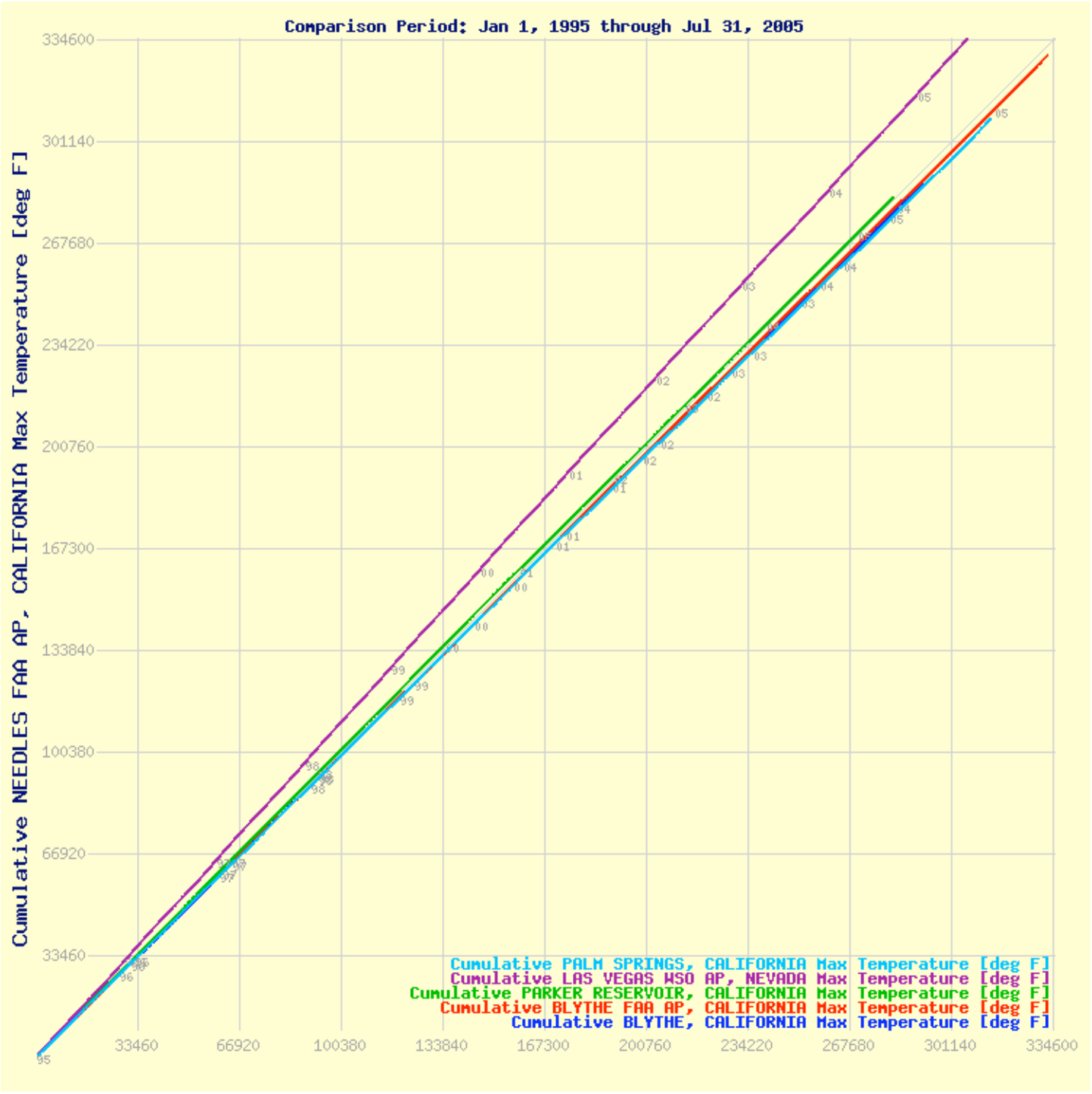
Vs

Nevada City
Vacaville
Davis
Woodland
Sacramento FAA

19,000 days


Sacramento City Daily
Max Temp
1951-2005
Vs
Nevada City
Vacaville
Davis
Woodland
Sacramento FAA
Accumulated Difference
from SACRAMENTO WSO CI, CALIFORNIA Max Temperature [deg F]
150840
134080
117320
100560
83800
67040
50280
33520
16760
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04
DAVIS 2 WSW EXP FRM, CALIFORNIA Max Temperature [deg F]
WOODLAND 1 WNW, CALIFORNIA Max Temperature [deg F]
SACRAMENTO FAA AP, CALIFORNIA Max Temperature [deg F]

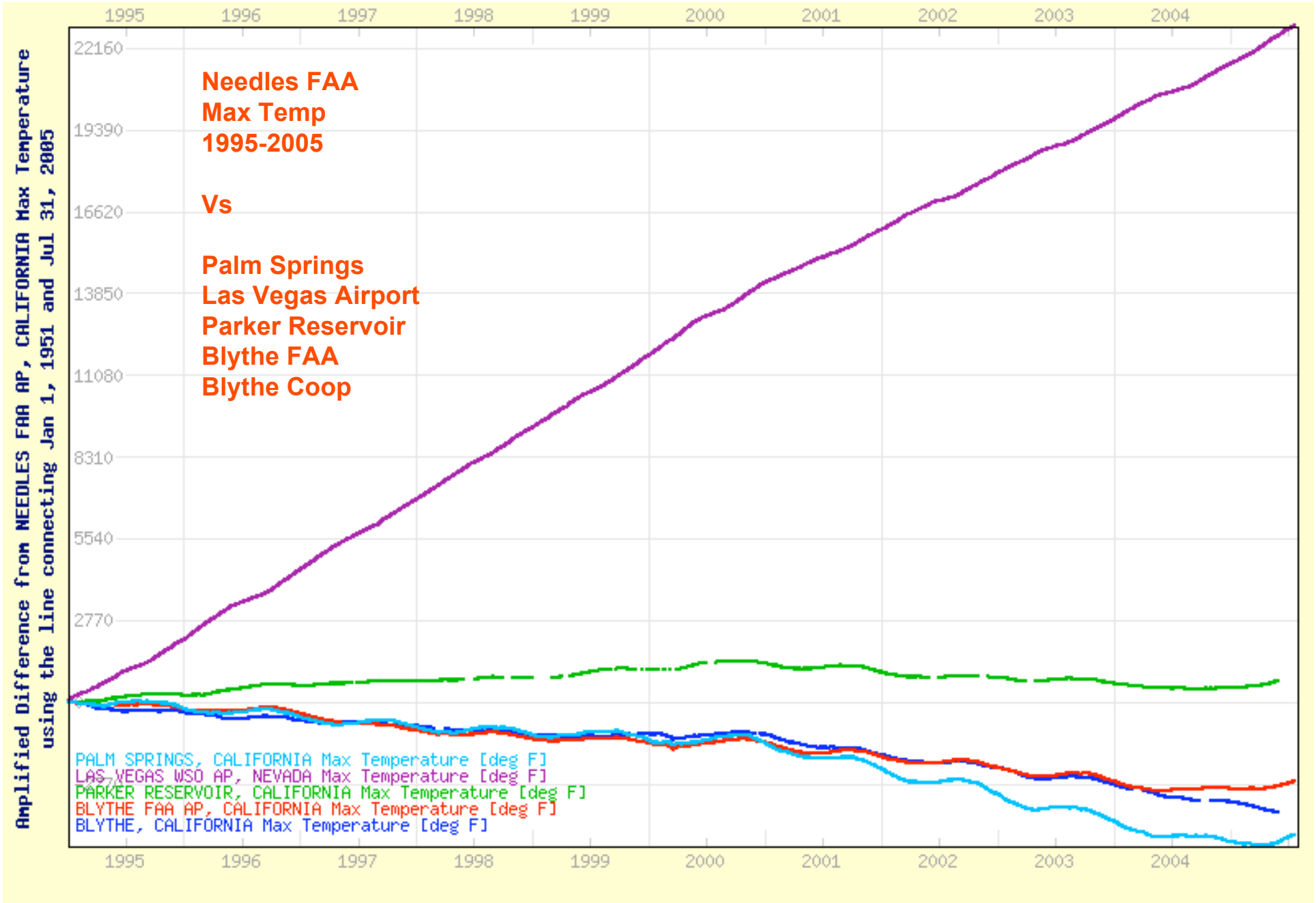

Amplified Difference from SACRAMENTO WSO CI, CALIFORNIA Max Temperature
using the line connecting Jan 1, 1951 and Jul 31, 2005
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04
-1980
-2970
-3960
-4950
-5940
-6930
-7920
Sacramento City Daily
Max Temp
1951-2005
Vs
Nevada City
Vacaville
Davis
Woodland
Sacramento FAA
NEVADA CITY, CALIFORNIA Max Temperature [deg F]
VACAVILLE, CALIFORNIA Max Temperature [deg F]
DAVIS 2 WSW EXP FRM, CALIFORNIA Max Temperature [deg F]
WOODLAND 1 WNW, CALIFORNIA Max Temperature [deg F]
SACRAMENTO FAA AP, CALIFORNIA Max Temperature [deg F]

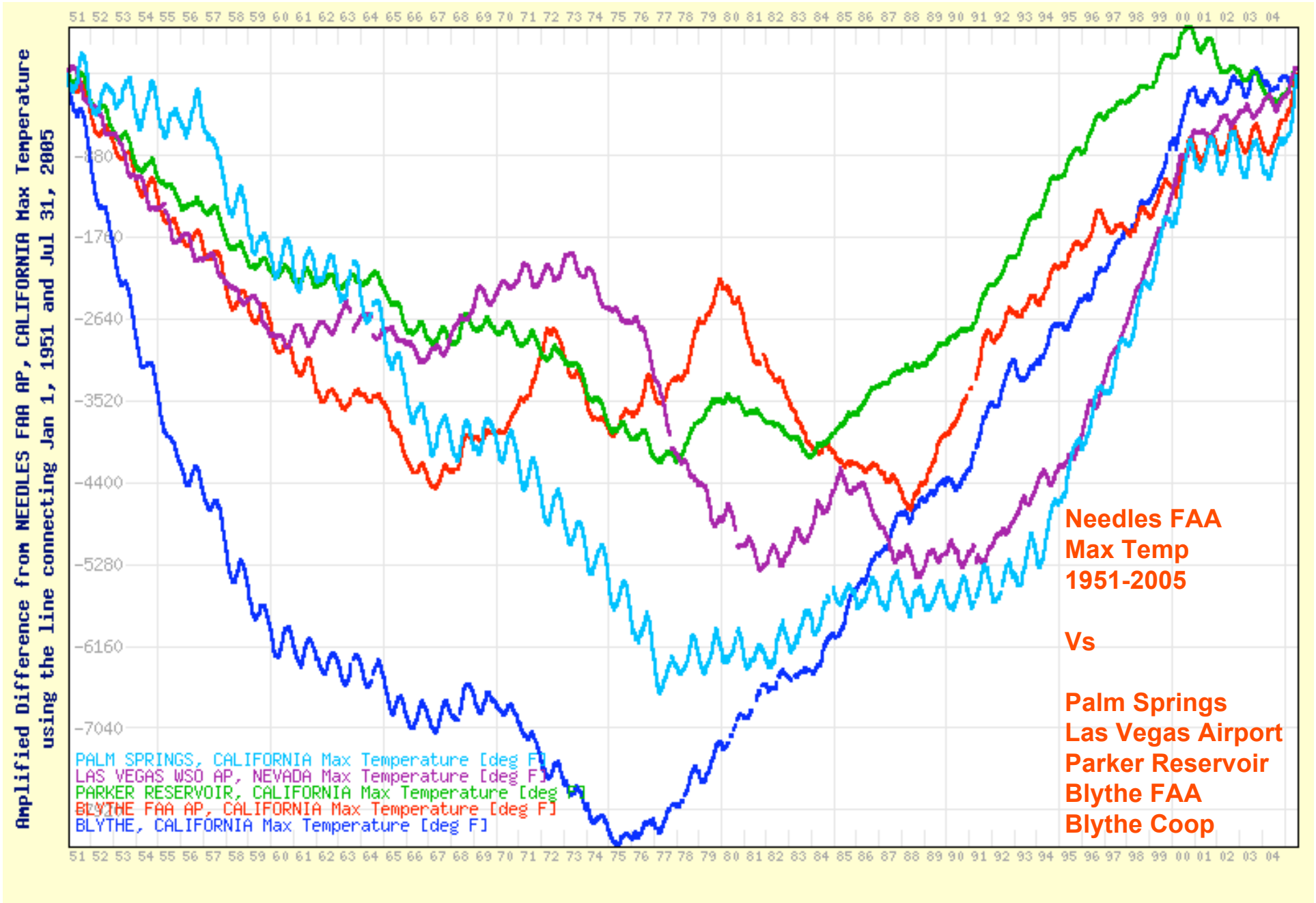


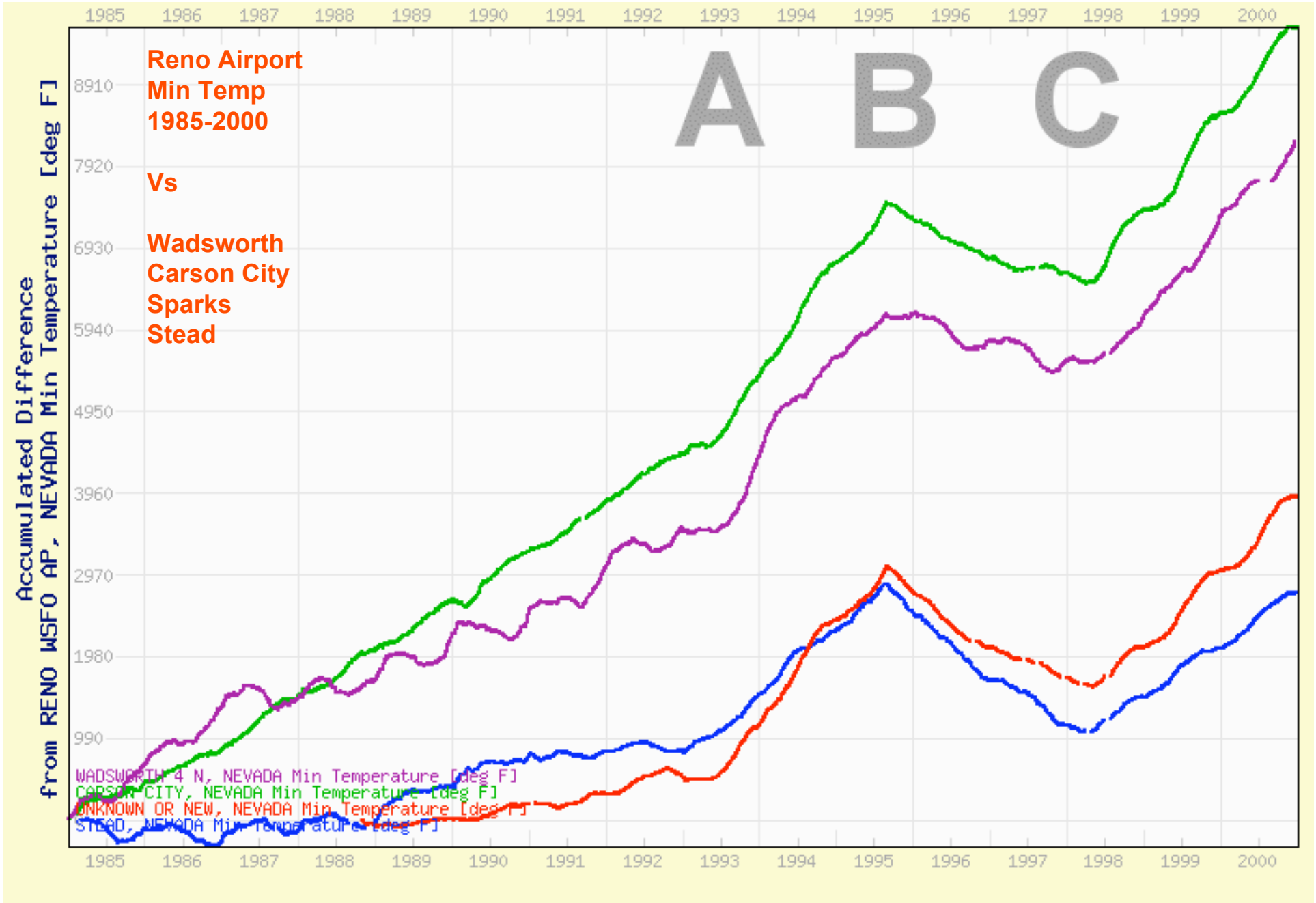
Needles FAA
Max Temp
1995-2005

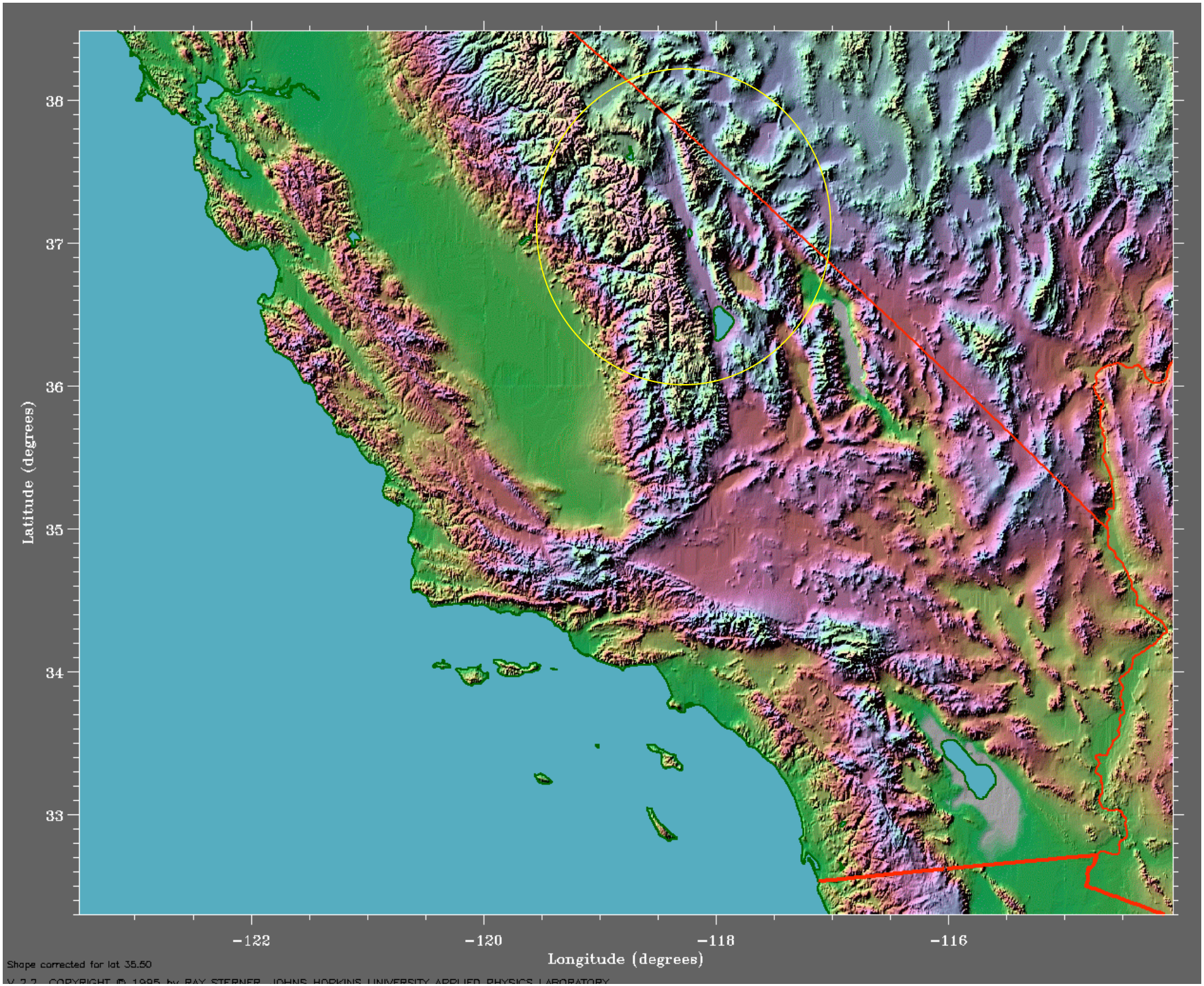
Vs

Palm Springs
Las Vegas
Airport
Parker Reservoir
Blythe FAA
Blythe Coop

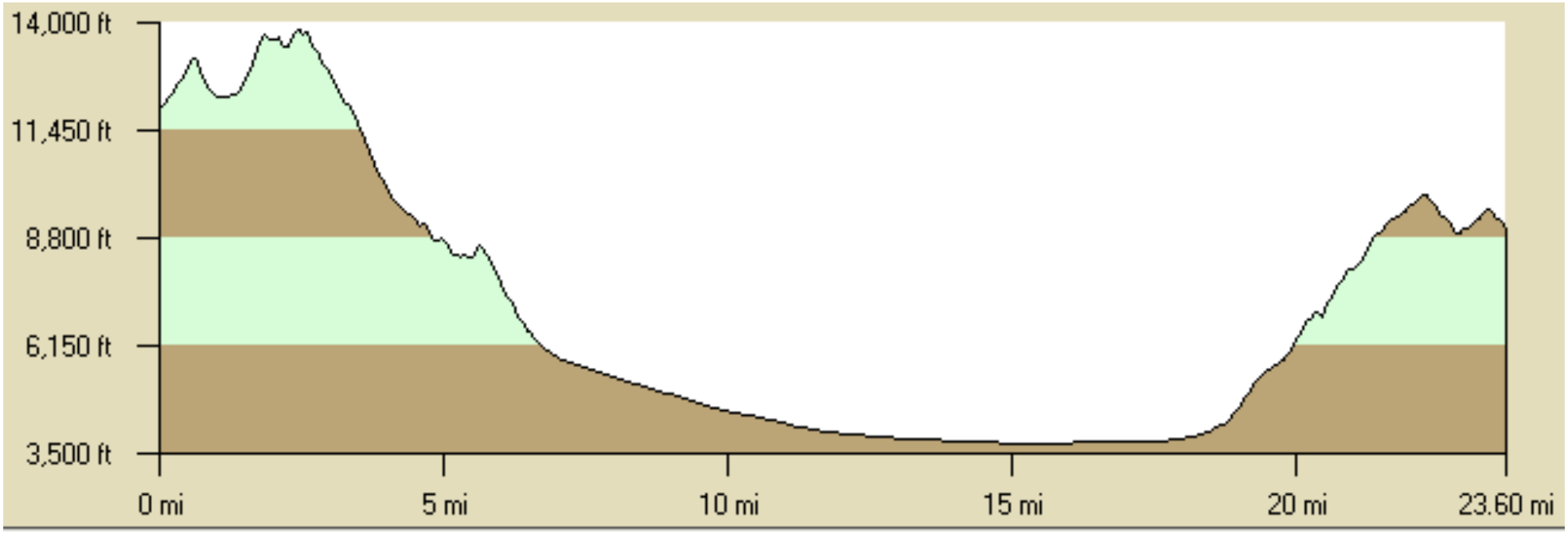

Amplified Difference from NEEDLES FAA AP, CALIFORNIA Max Temperature
using the line connecting Jan 1, 1951 and Jul 31, 2005
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
22160
19390
16620
13850
11080
8310
5540
2770
Needles FAA
Max Temp
1995-2005
Vs
Palm Springs
Las Vegas Airport
Parker Reservoir
Blythe FAA
Blythe Coop
PALM SPRINGS, CALIFORNIA Max Temperature [deg F]
LAS VEGAS WSO AP, NEVADA Max Temperature [deg F]
PARKER RESERVOIR, CALIFORNIA Max Temperature [deg F]
BLYTHE FAA AP, CALIFORNIA Max Temperature [deg F]
BLYTHE, CALIFORNIA Max Temperature [deg F]


Amplified Difference from NEEDLES FAA AP, CALIFORNIA Max Temperature
using the line connecting Jan 1, 1951 and Jul 31, 2005
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04
-880
-1760
-2640
-3520
-4400
-5280
-6160
-7040
PALM SPRINGS, CALIFORNIA Max Temperature [deg F]
LAS VEGAS WSO AP, NEVADA Max Temperature [deg F]
PARKER RESERVOIR, CALIFORNIA Max Temperature [deg F]
BLYTHE FAA AP, CALIFORNIA Max Temperature [deg F]
BLYTHE, CALIFORNIA Max Temperature [deg F]
Needles FAA
Max Temp
1951-2005
Vs
Palm Springs
Las Vegas Airport
Parker Reservoir
Blythe FAA
Blythe Coop

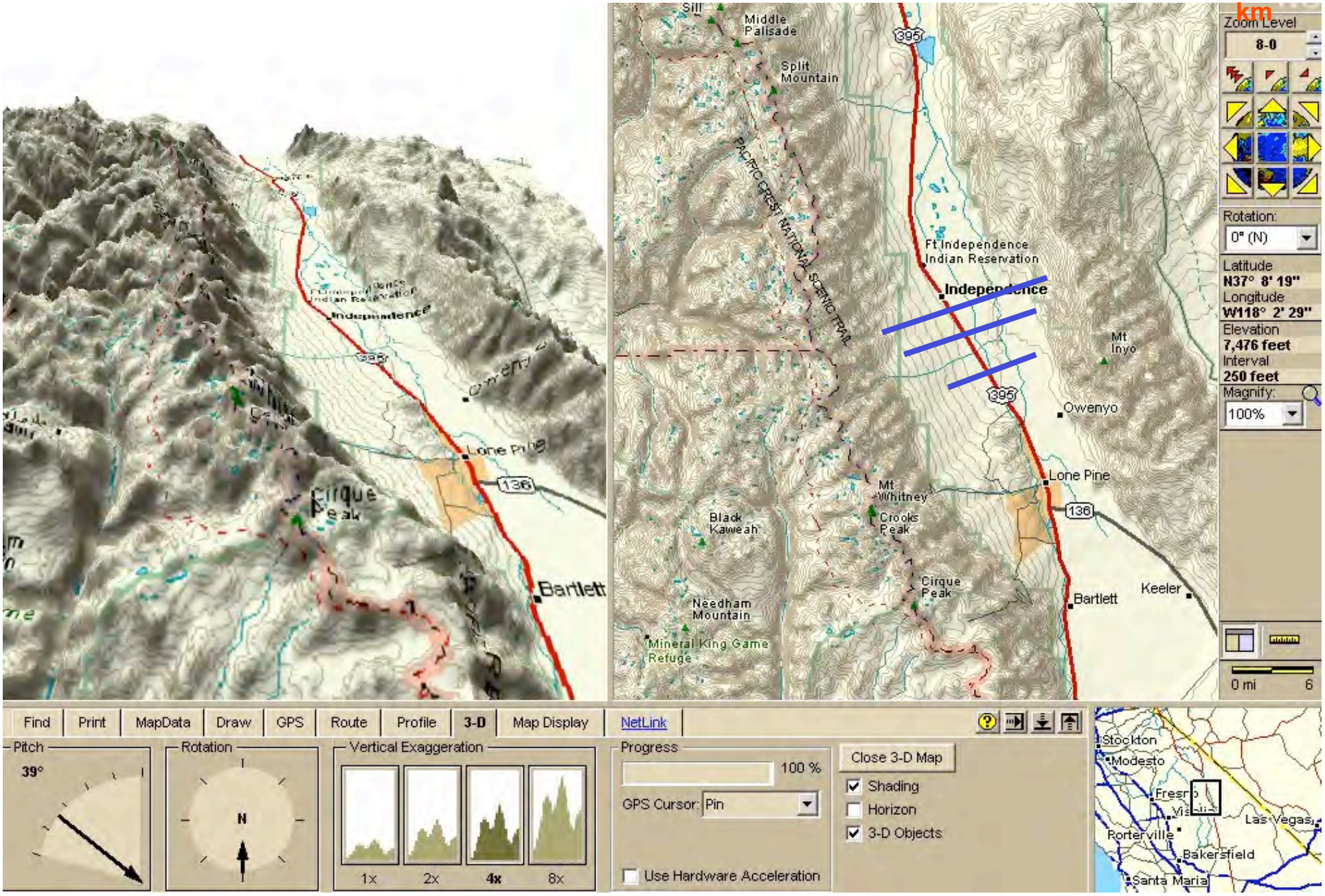

Reno Airport
Min Temp
1985-2000
Vs
Wadsworth
Carson City
Sparks
Stead
A
B
C
Accumulated Difference
from RENO WSFO AP, NEVADA Min Temperature [deg F]
8910
7920
6930
5940
4950
3960
2970
1980
990
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
WADSWORTH 4 N, NEVADA Min Temperature [deg F]
CARSON CITY, NEVADA Min Temperature [deg F]
UNKNOWN OR NEW, NEVADA Min Temperature [deg F]
STEAD, NEVADA Min Temperature [deg F]


38
37
36
35
34
33
Latitude (degrees)
−122
−120
−118
−116
Longitude (degrees)
Shape corrected for lat 35.50
V 2.2 COPYRIGHT © 1995 by RAY STERNER, JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

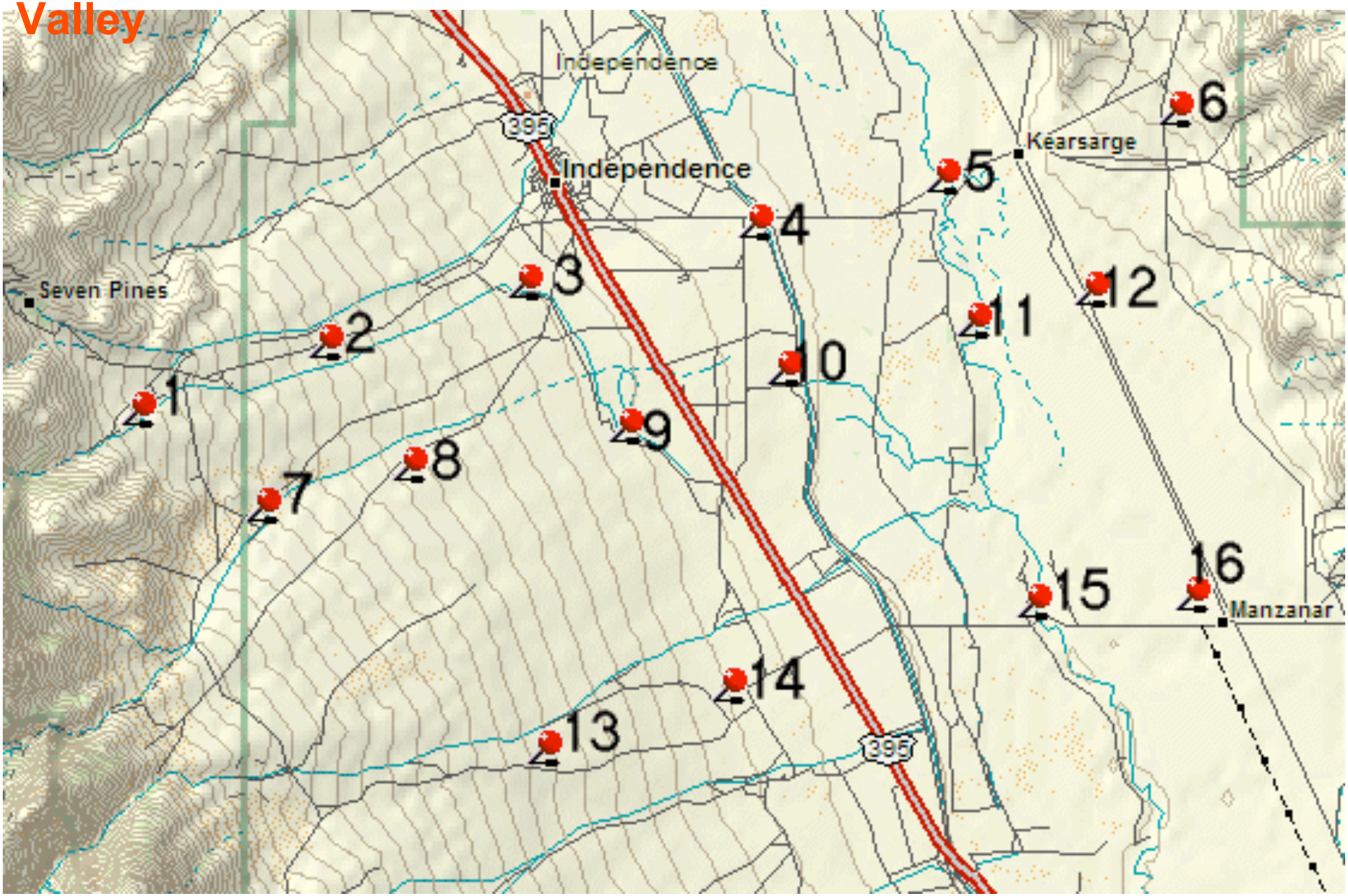
Elevation Transect Across Owens Valley south of Independence CA
Vertical Exaggeration Approximately 4 X

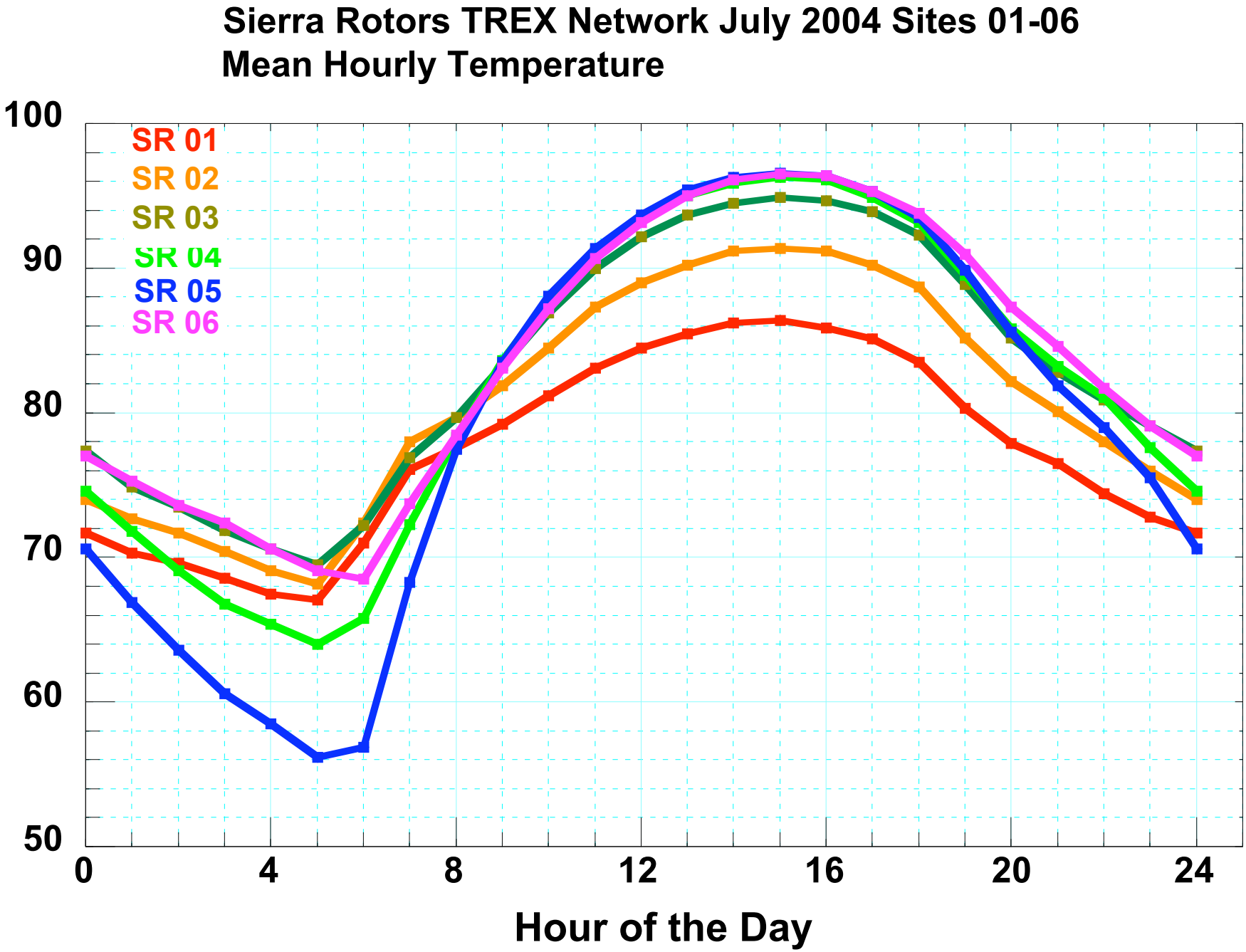


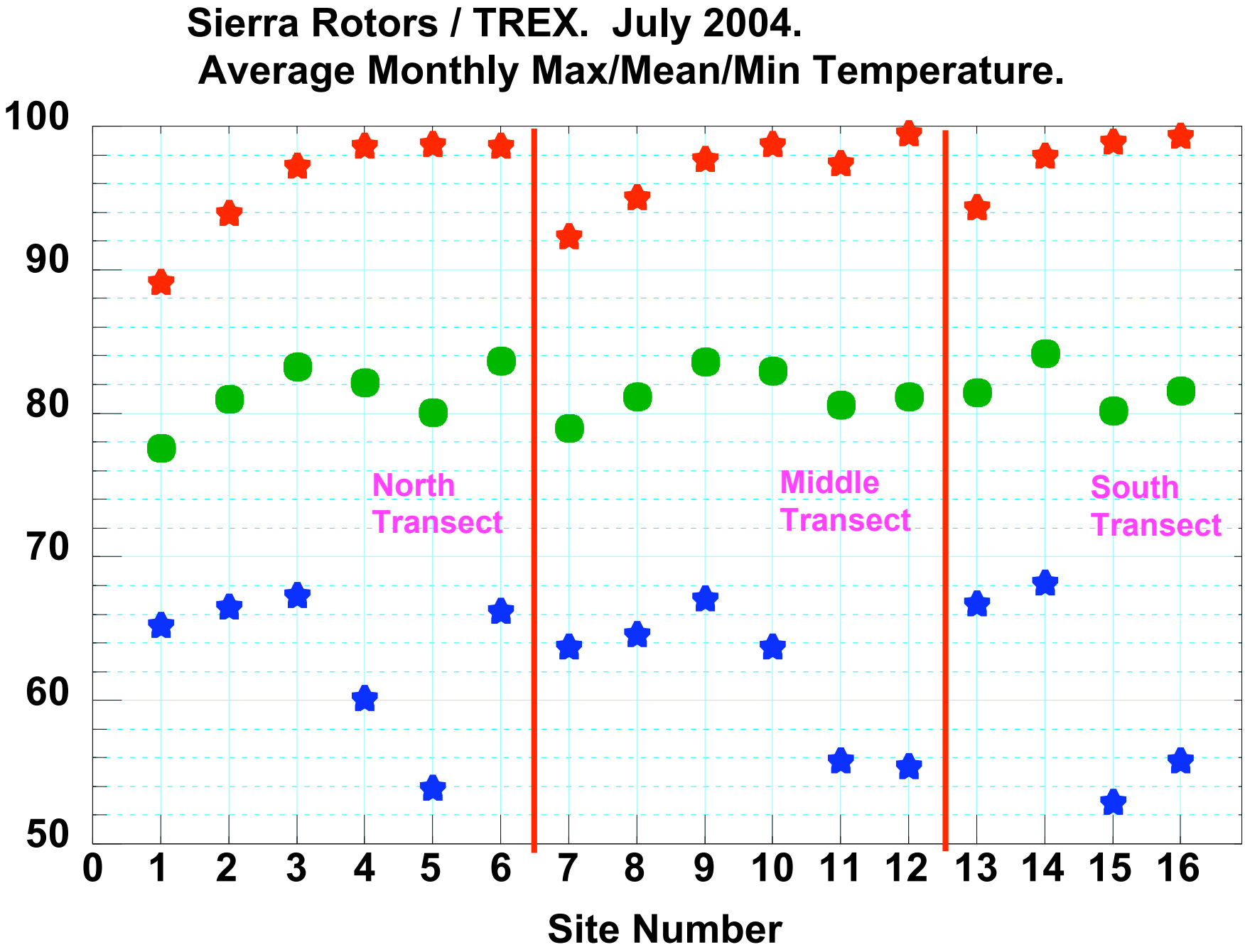
TREX – Terrain Induced Rotors Experiment
Independence CA Owens Valley

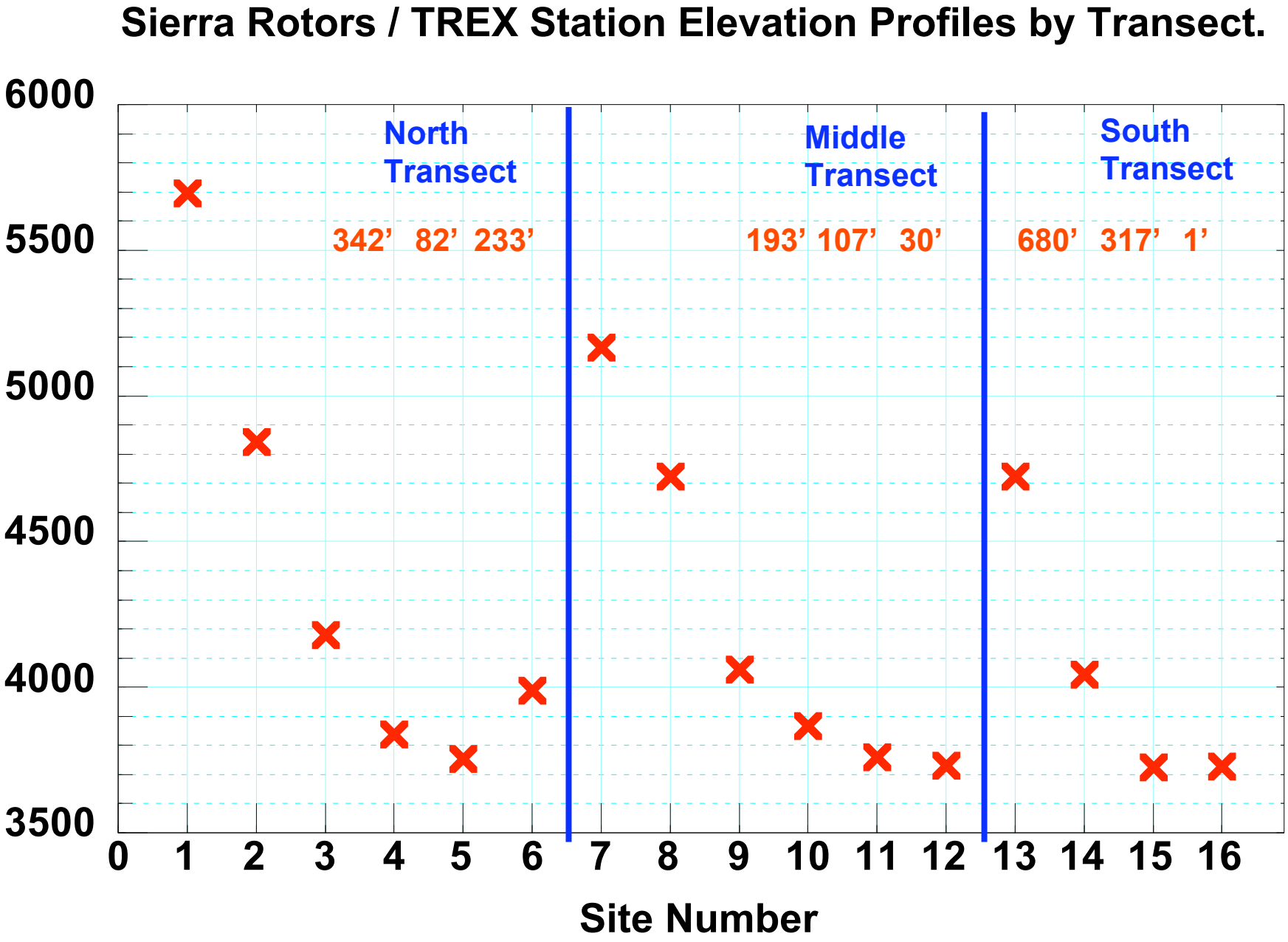


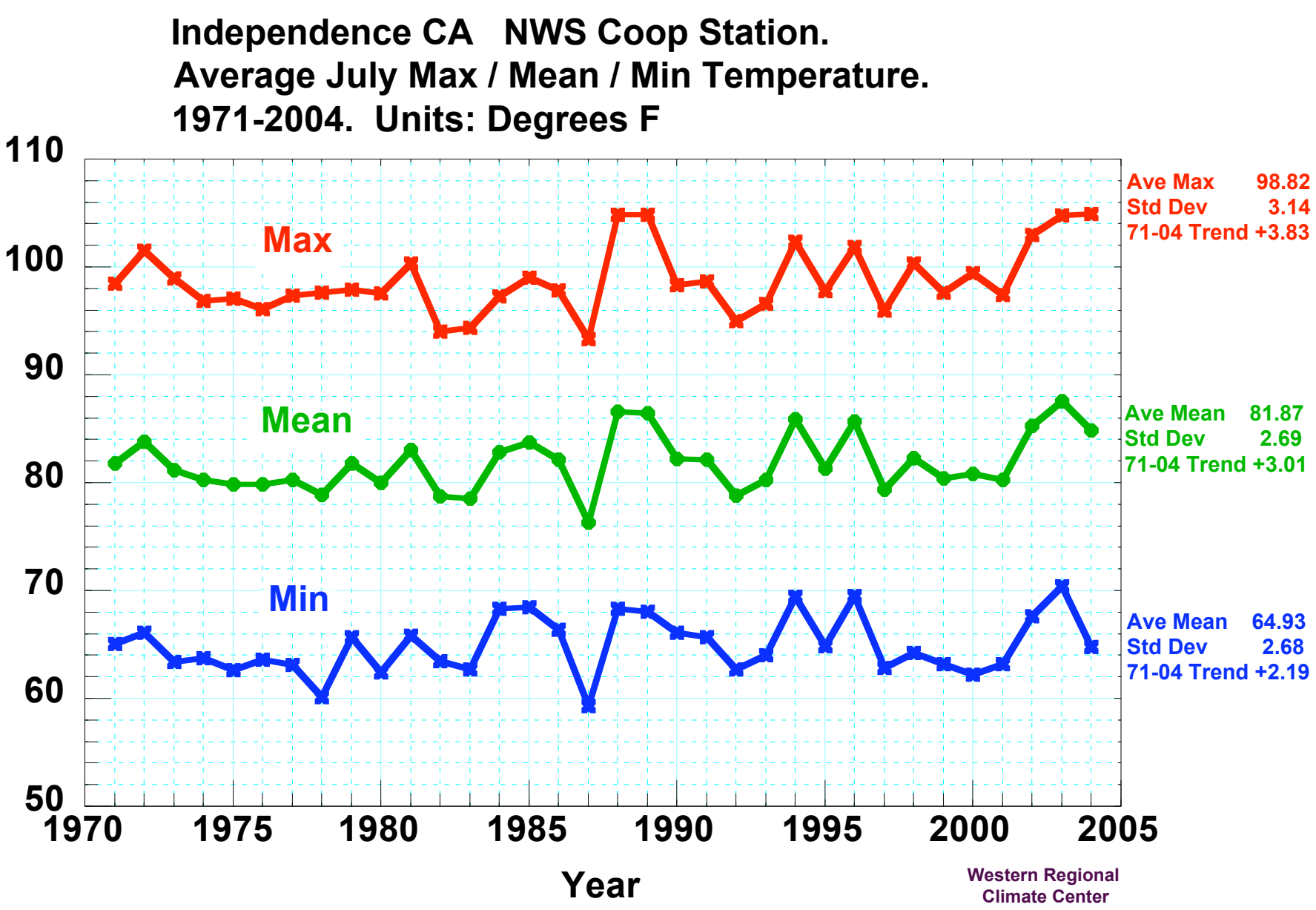
TREX – Terrain Induced Rotors Experiment Independence CA Owens Valley




Sierra Rotors TREX Network July 2004 Sites 01-06
Mean Hourly Temperature
SR 01
SR 02
SR 03
SR 04
SR 05
SR 06
100
90
80
70
60
50
0
4
8
12
16
20
24
Hour of the Day


Sierra Rotors / TREX. July 2004.
Average Monthly Max/Mean/Min Temperature.
100
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
North Transect
Middle Transect
South Transect
Site Number


Sierra Rotors / TREX Station Elevation Profiles by Transect.
6000
5500
5000
4500
4000
3500
North
Transect
Middle
Transect
South
Transect
342’ 82’ 233’
193’ 107’ 30’
680’ 317’ 1’
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Site Number
Elevation difference between adjoining stations


Independence CA NWS Coop Station.
Average July Max / Mean / Min Temperature.
1971-2004. Units: Degrees F
110
100
90
80
70
60
50
1970
1975
1980
1985
1990
1995
2000
2005
Year
Max
Mean
Min
Ave Max 98.82
Std Dev 3.14
71-04 Trend +3.83
Ave Mean 81.87
Std Dev 2.69
71-04 Trend +3.01
Ave Mean 64.93
Std Dev 2.68
71-04 Trend +2.19
Western Regional
Climate Center

CEC / CIEE Enhanced California Climate Monitoring Project - 1

10-15 Full or augmented stations possible.

Transects / clusters across strong climatic gradients: coast and mountains.

Transects across relatively unobserved areas.

Transects across relatively simple topography & geometry when feasible.

A few long term sites in San Francisco Bay area away from artificial influences (but can leverage with area groups, NPS, etc)

Coastal points and headlands (coordinated with Coastal Ocean Obs System).

Long term site stability and acceptable exposure is a priority.

Willing site hosts for power, communications, to anticipate maintenance.

Mountaintop sites (White Mtns (3), Mt Warren, Slide Mt, Mt Hoffman, Mammoth?)

Platforms for added instruments (aerosols, solar radiation, etc)

CEC / PIER Enhanced California Climate Monitoring Project - 2

Coordinate with CEC Sierra obs, NOAA Hydromet Test Bed, CODAR/OOS, other coastal, CRN, NPS I&M, NOAA-NWS, air quality networks, NOAA Climate Test Bed, others)

Identify areas to deploy equipment if future resources materialize

Southeastern deserts, northeast plateau, Sierra north-to-south, Klamath River interior coastal

Facilitate an east-side strong-gradient cluster (Sierra – Owens – White/Inyo).

ECCM Strategy as of September 2005

Special California CRN stations appear to be too expensive for ECCM

One or two transects from the near shore ocean to far western Great Basin.

Augment selected Sierra mountaintops.

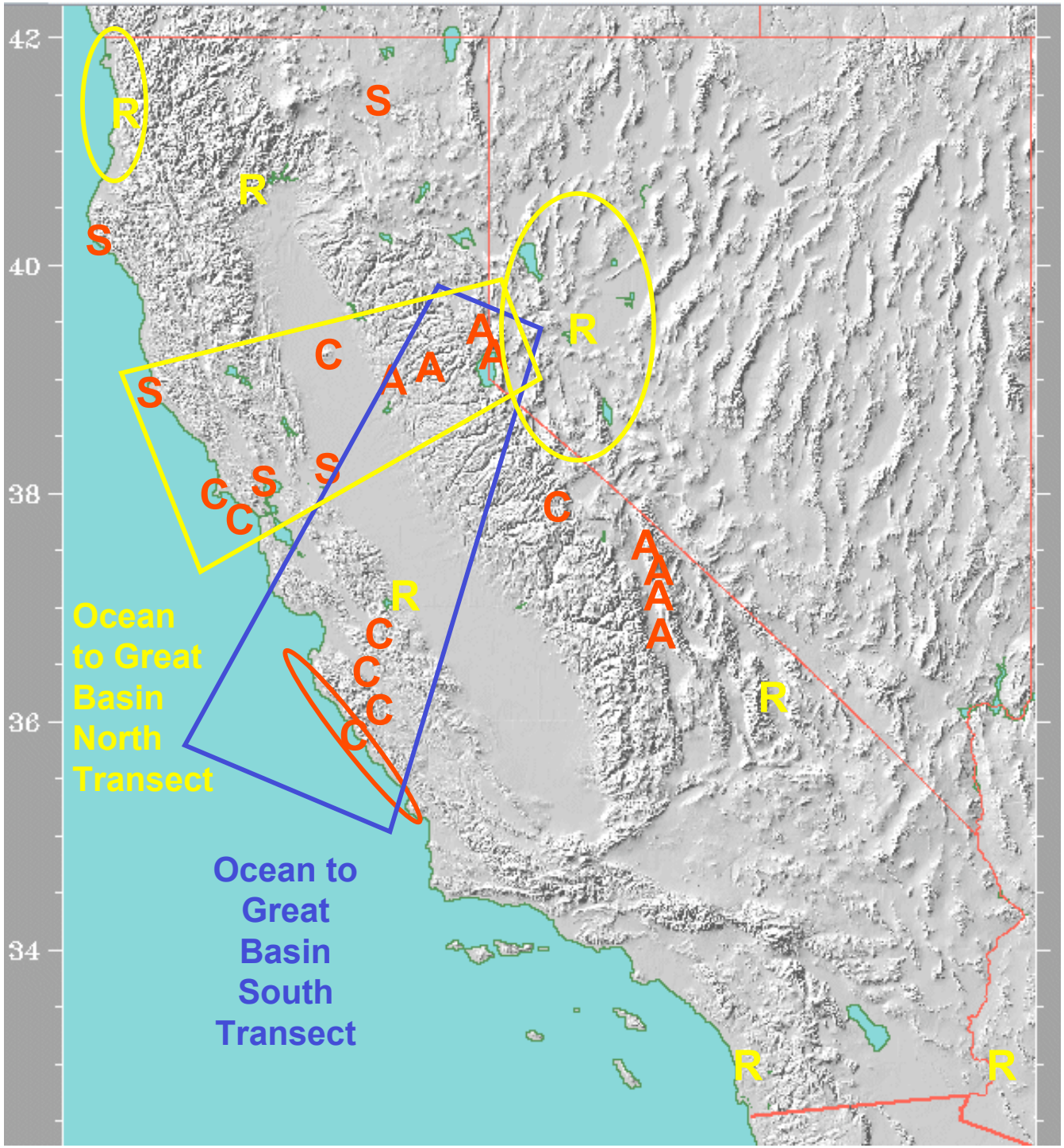
Leverage other current and planned projects.

R – Existing or "expected" national CRN

C – Potential New California Climate Monitoring Site

A – Potential Augmentation Site

S – Additional sites of opportunity



Coasts in the United States

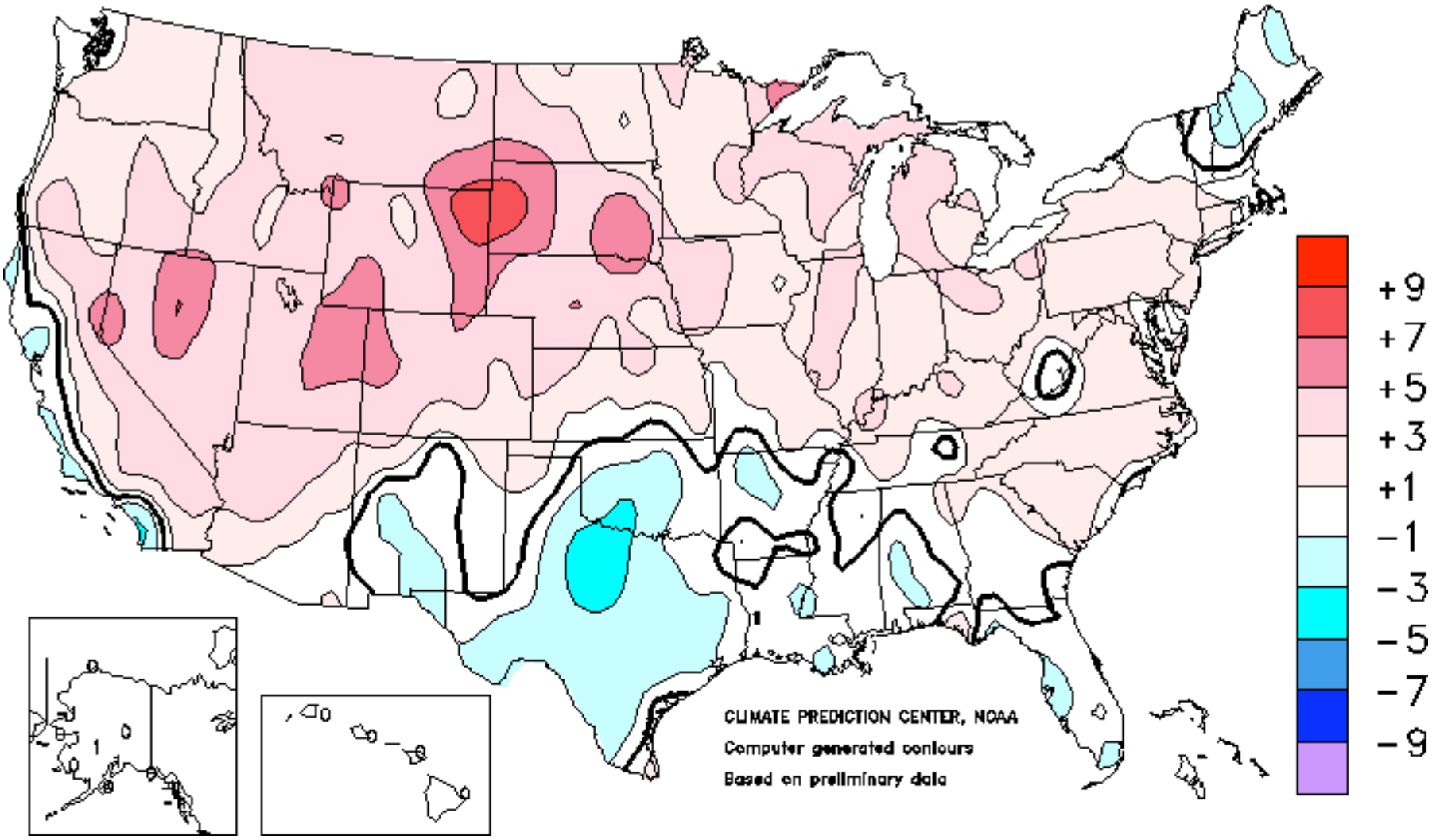
	Low resolution	Details to 100’
California	840	3427 miles
WA,OR,CA	1293	7863
Hawaii	750	1052
Alaska (Pacific)	5580	31383
Pacific	7623	40298
Atlantic	2069	28673
Gulf	1631	17141
Arctic	1060	2521
Total US Coast	12383	88633

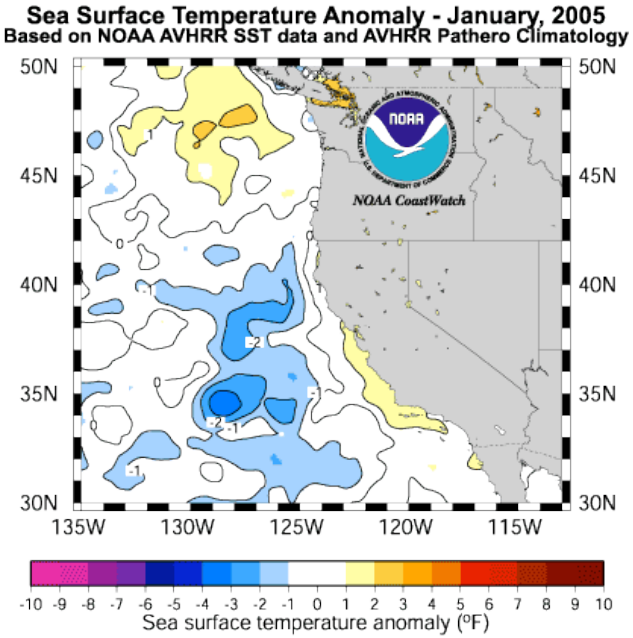
“How long is the coast of Great Britain?” problem – scaling and fractals

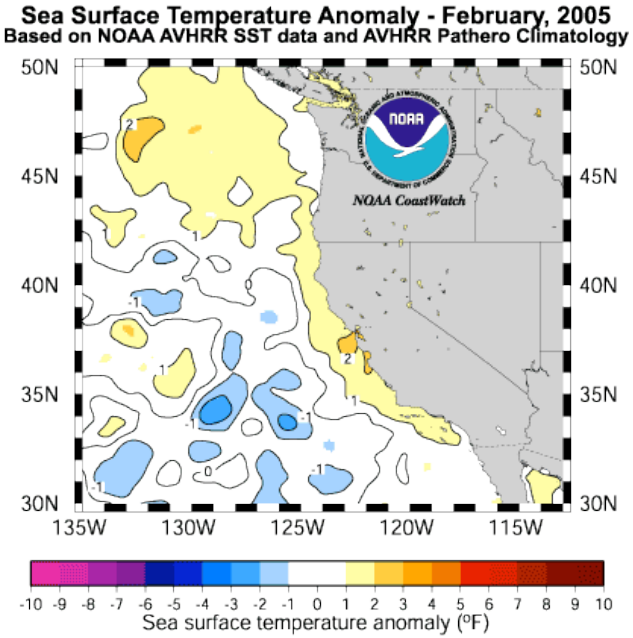
Source: National Ocean Service, infoplease.com. Details 1939-40.

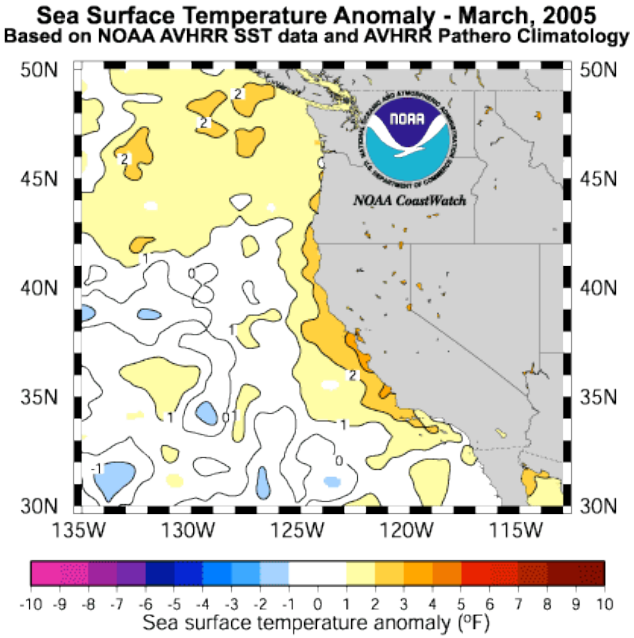
Departure of Average Temperature from Normal (°F)

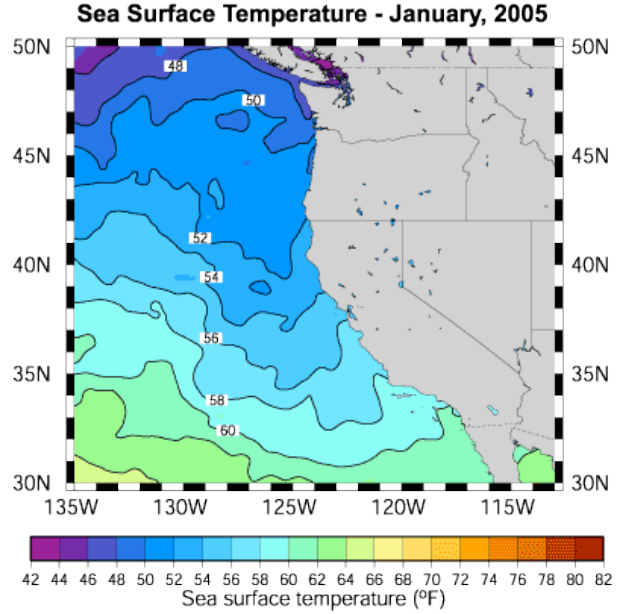
July 2002

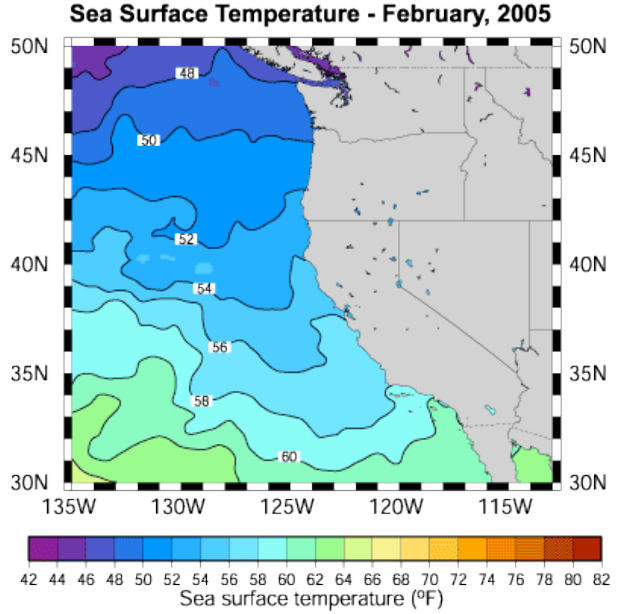


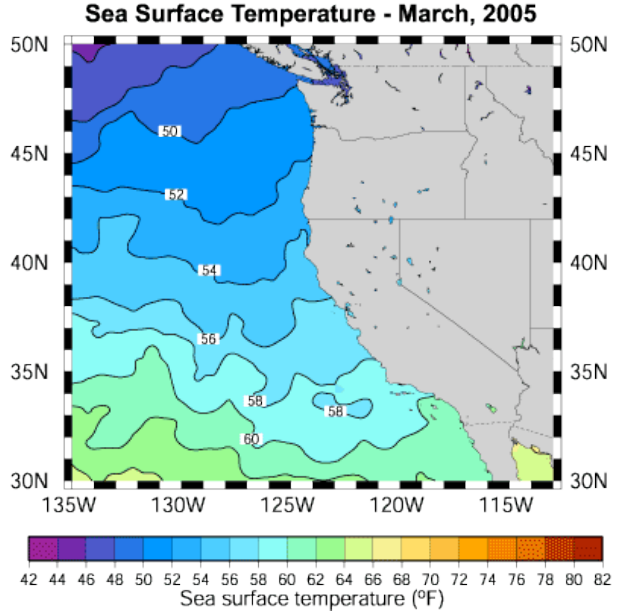




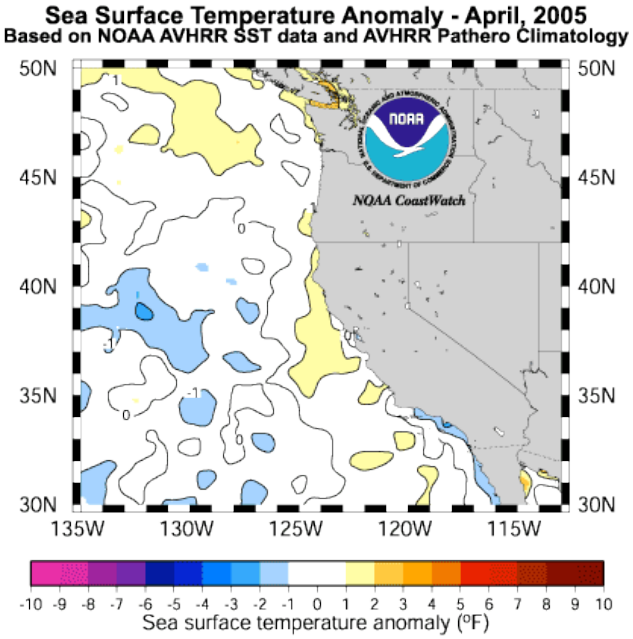


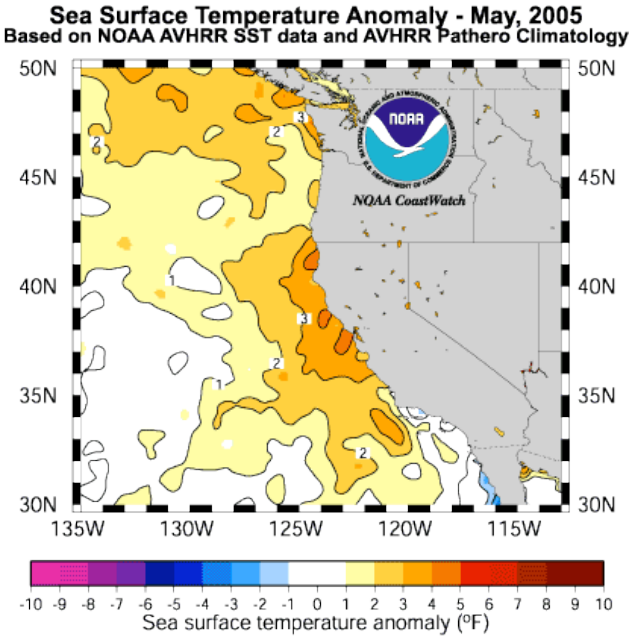


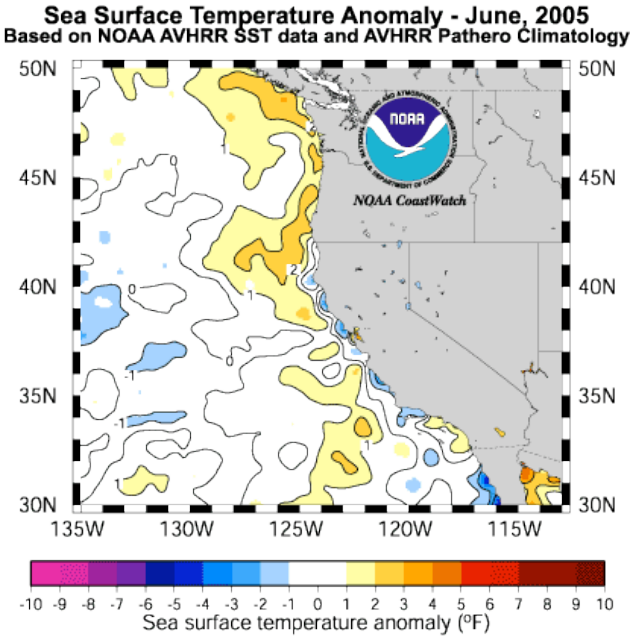


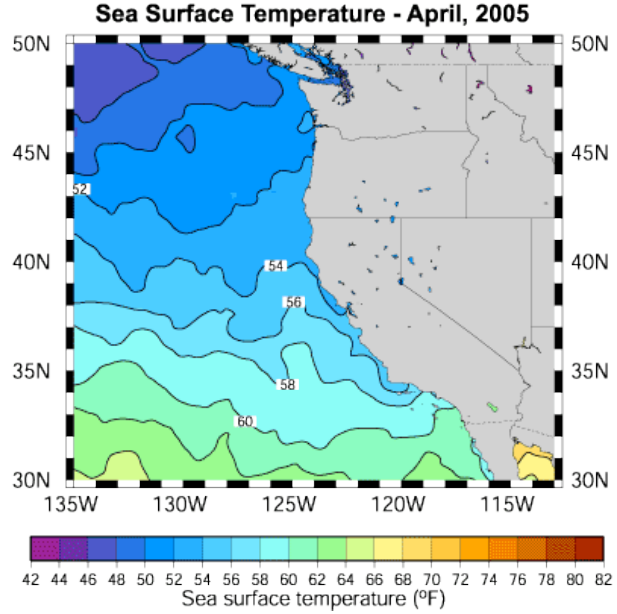


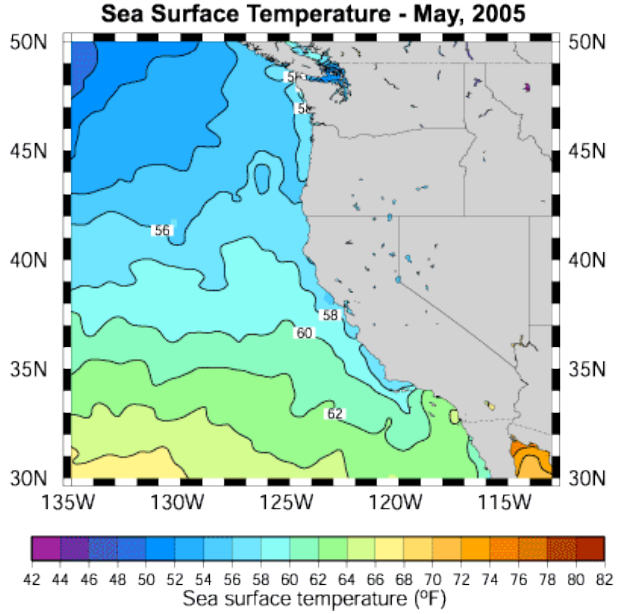
January 2005 **February 2005** **March 2005**

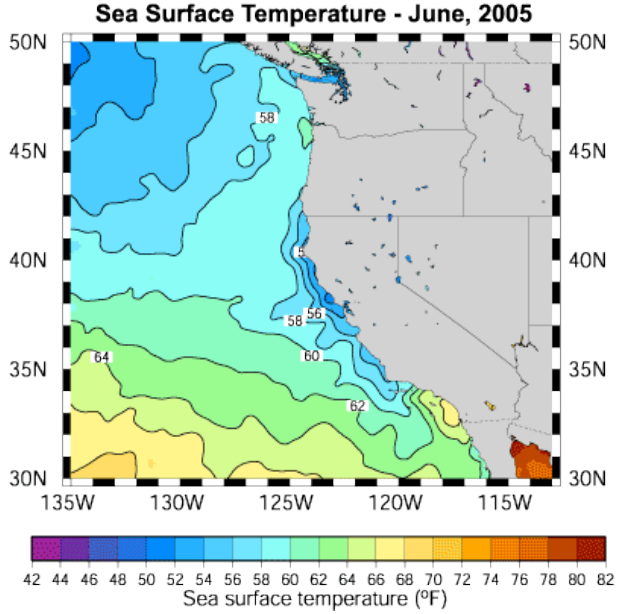




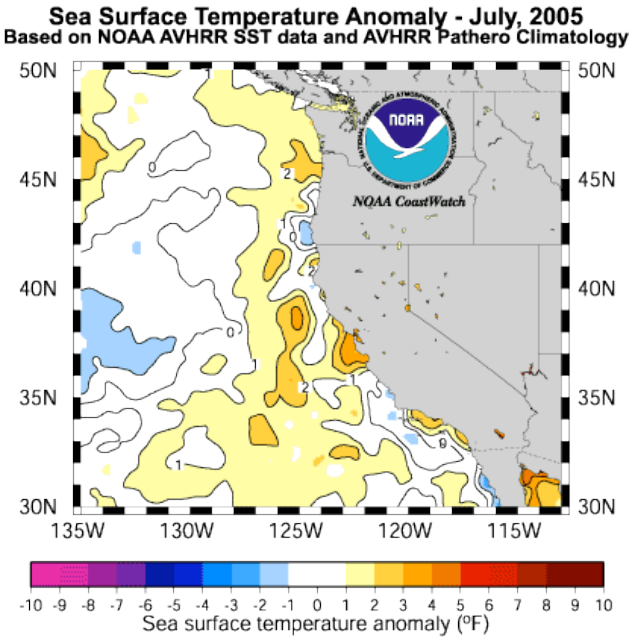


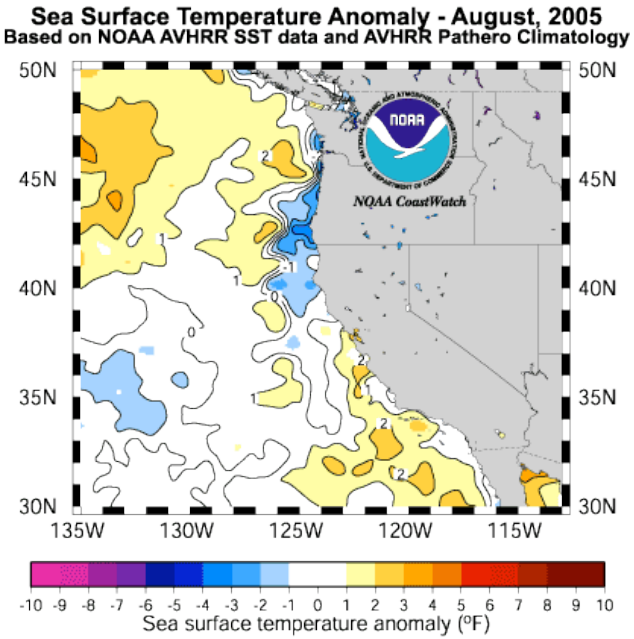


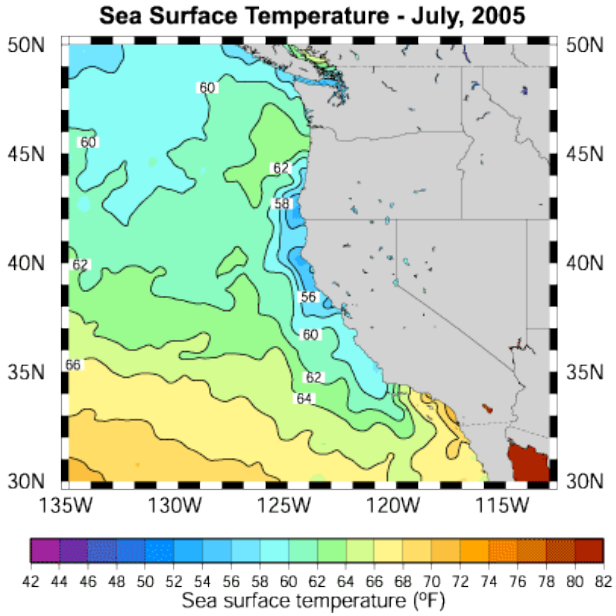


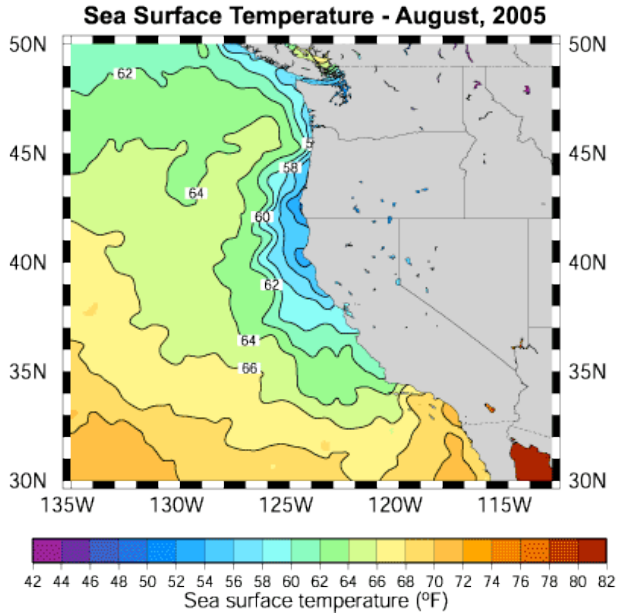


April 2005 **May 2005** **June 2005**









July 2005

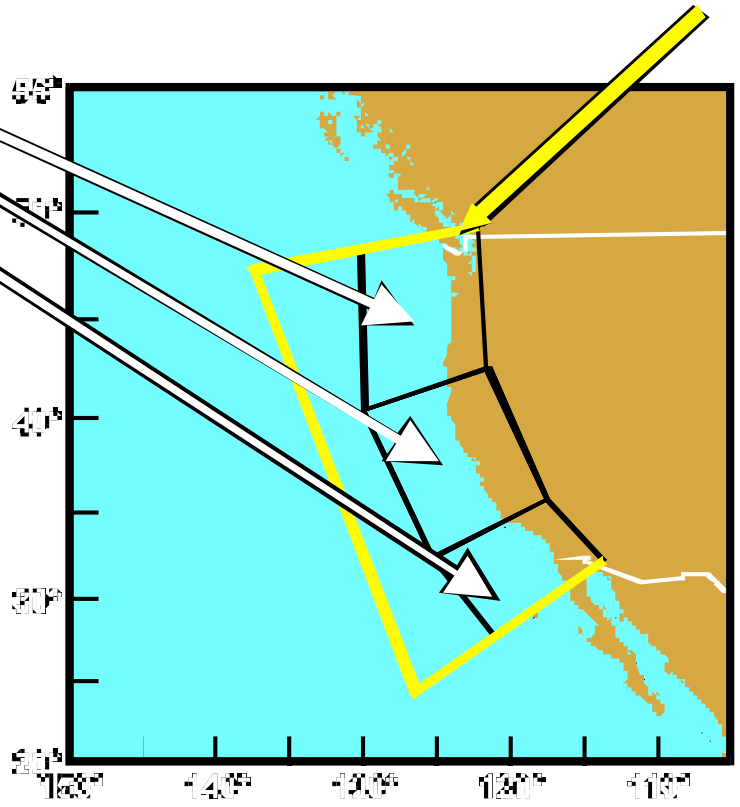
August 2005

Coastal - Integrated Ocean Observing System (IOOS) in the California Current System of the US

Regional Coastal Ocean Observing System

NaNOOS
CenCOOS
SCCOOS

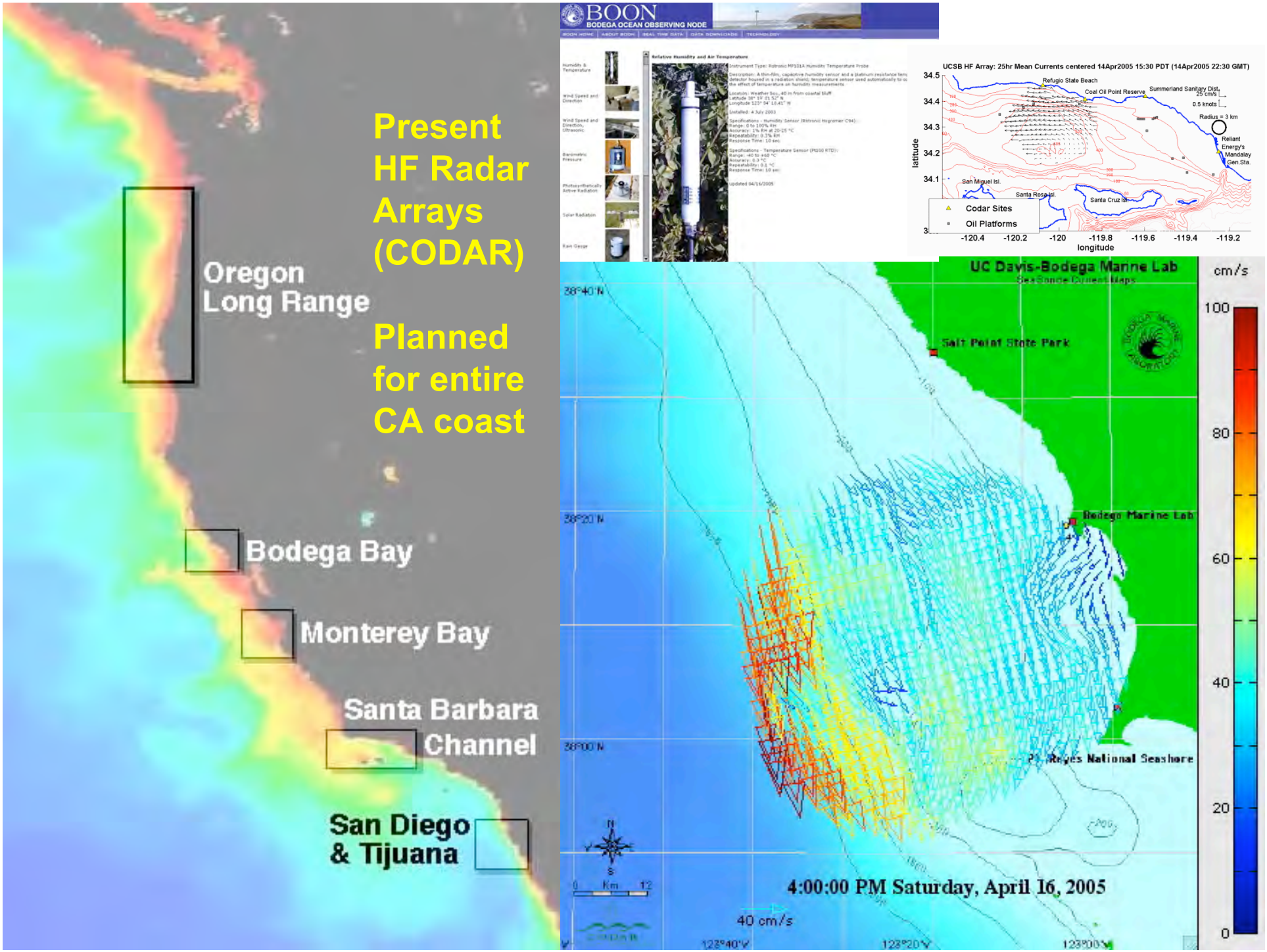
- Enhances National Backbone
- Increased time space resolution
- Transitional nature
- R & D projects
- Coastal radar network
- Involves private sector
- Serves local user needs



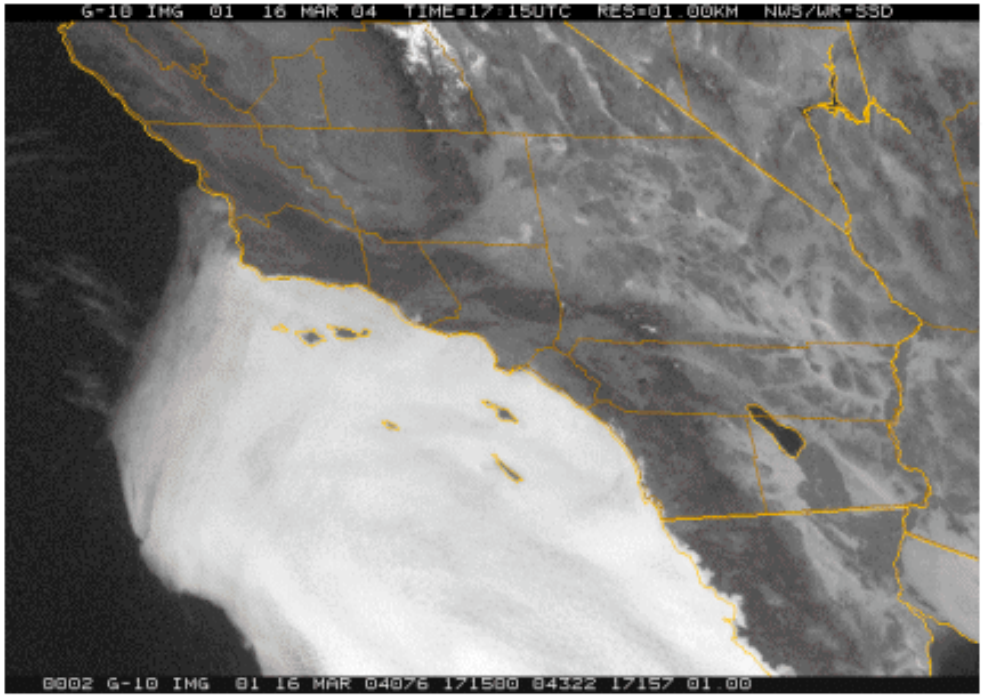
National Backbone PaCOOS Contributions

- US EEZ Coastwide:
  - Ecosystem observations
  - Species Inventories
  - Process variables
  - Catch & bycatch
- Maintain Sentinel Species Lines of observation
- Serves ecosystem-based resource management
- Provides offshore boundary conditions for regional systems

Source: www.pacoos.org/Pages/readings.htm


Present HF Radar Arrays (CODAR)
Planned for entire CA coast
Oregon Long Range
Bodega Bay
Monterey Bay
Santa Barbara Channel
San Diego & Tijuana
BOON
BODEGA OCEAN OBSERVING NODE
UCSB HF Array: 25hr Mean Currents centered 14Apr2005 15:30 PDT (14Apr2005 22:30 GMT)
Refugio State Beach
Coal Oil Point Reserve
Summerland Sanitary Dist.
25 cm/s
0.5 knots
Radius = 3 km
Reliant Energy's Mandalay Gen.Sta.
San Miguel Isl.
Santa Rosa Isl.
Santa Cruz Isl.
Codar Sites
Oil Platforms
latitude
longitude
UC Davis-Bodega Marine Lab
Salt Point State Park
Bodega Marine Lab
Pt. Reyes National Seashore
4:00:00 PM Saturday, April 16, 2005
40 cm/s
cm/s

Channel Islands National Park: Design Considerations for Weather and Climate Monitoring



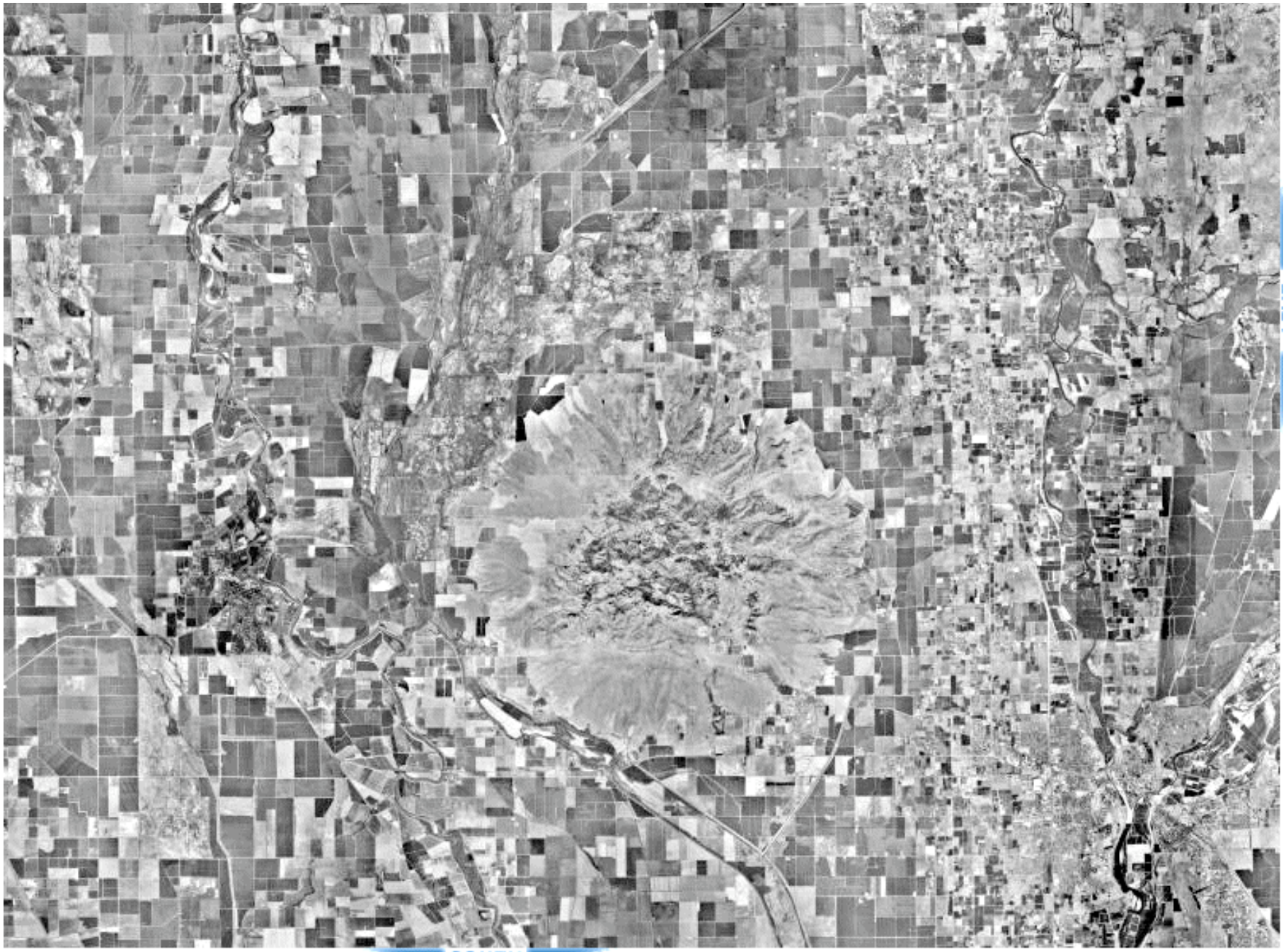
Kelly Redmond
Greg McCurdy

Report WRCC 05-02
July 2005

Western Regional Climate Center
Desert Research Institute
2215 Raggio Parkway
Reno Nevada 89512-1095

Final copy can be found at

ftp.wrcc.dri.edu/nps/chis

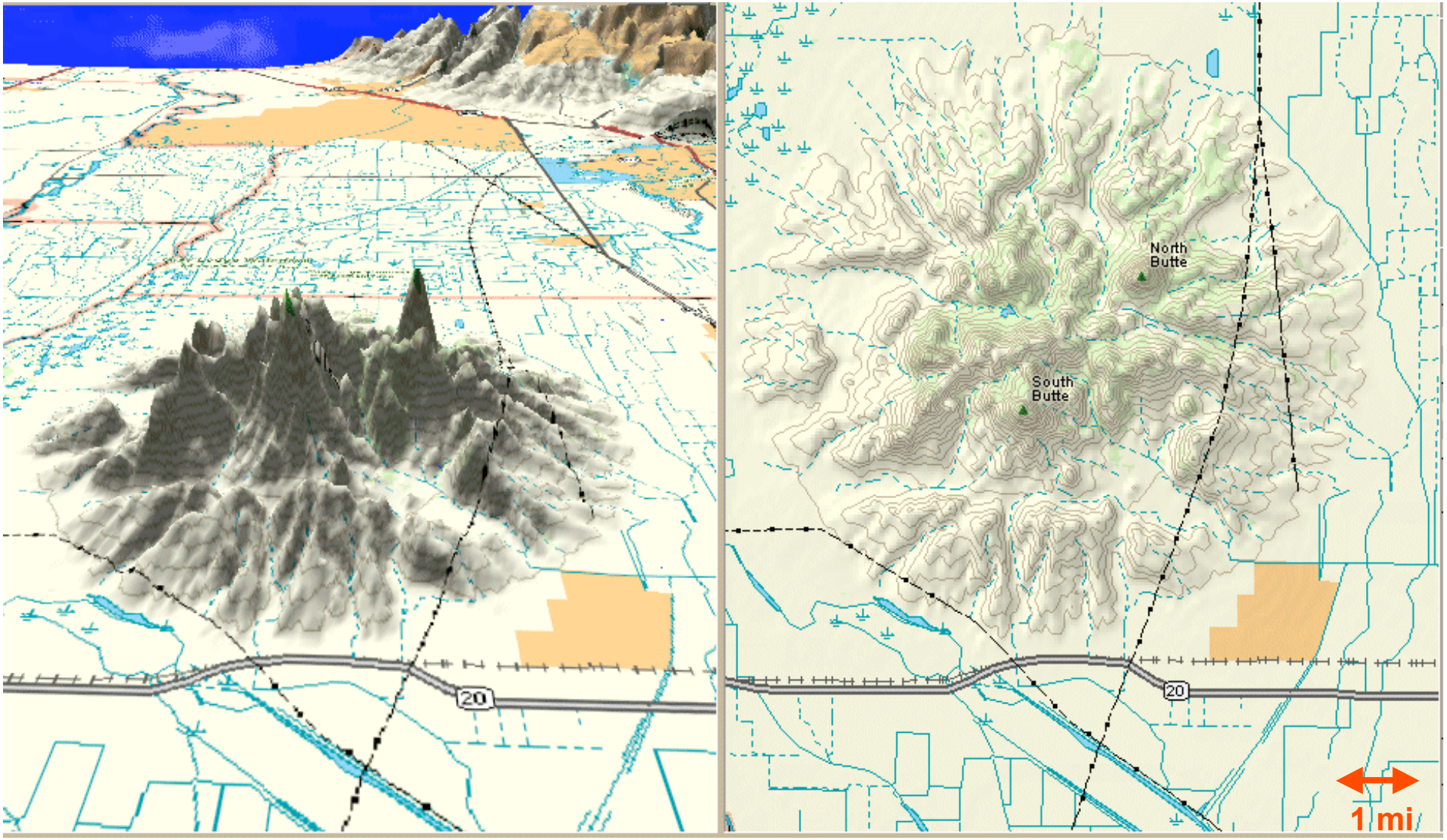


cal Survey

Sutter Buttes

km 2 4 6 8 10
mi 2 4 6

Sutter Buttes



Temporal Variability of

Orographic Effect on Precipitation

Sacramento (10’)

Versus

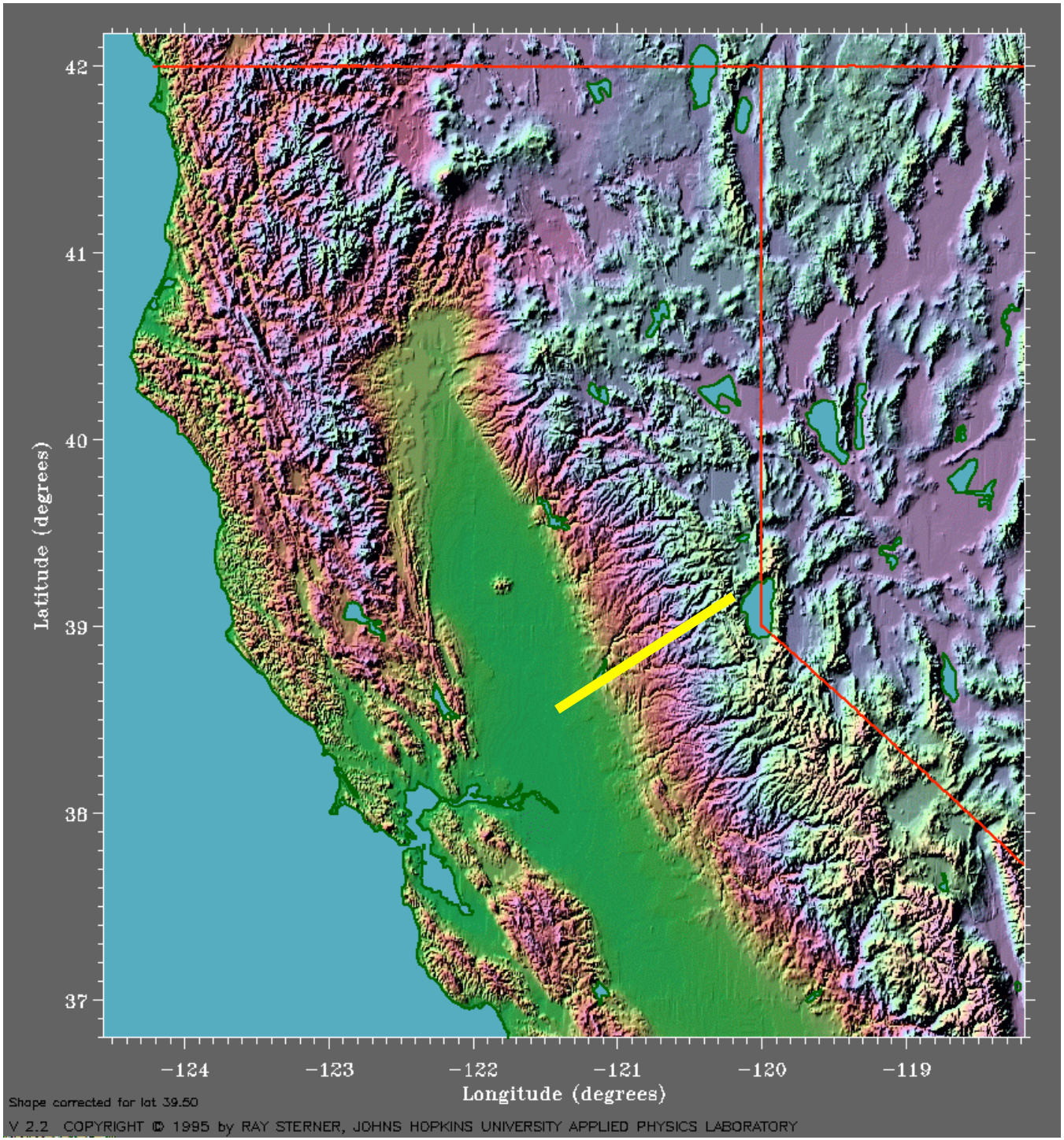
Tahoe City (6230’)

July thru June

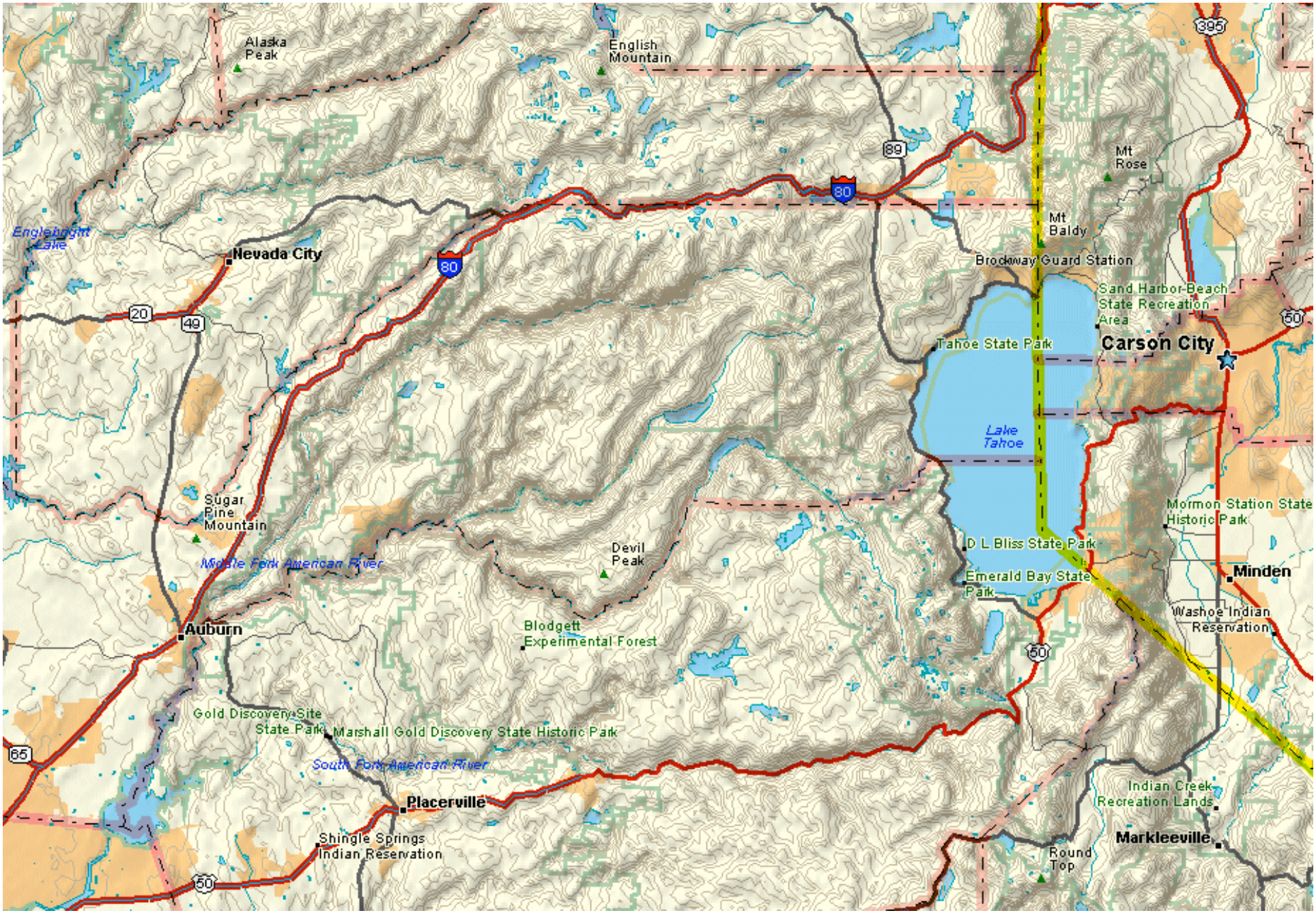
Oct-March Percent of Annual:

83% at Tahoe

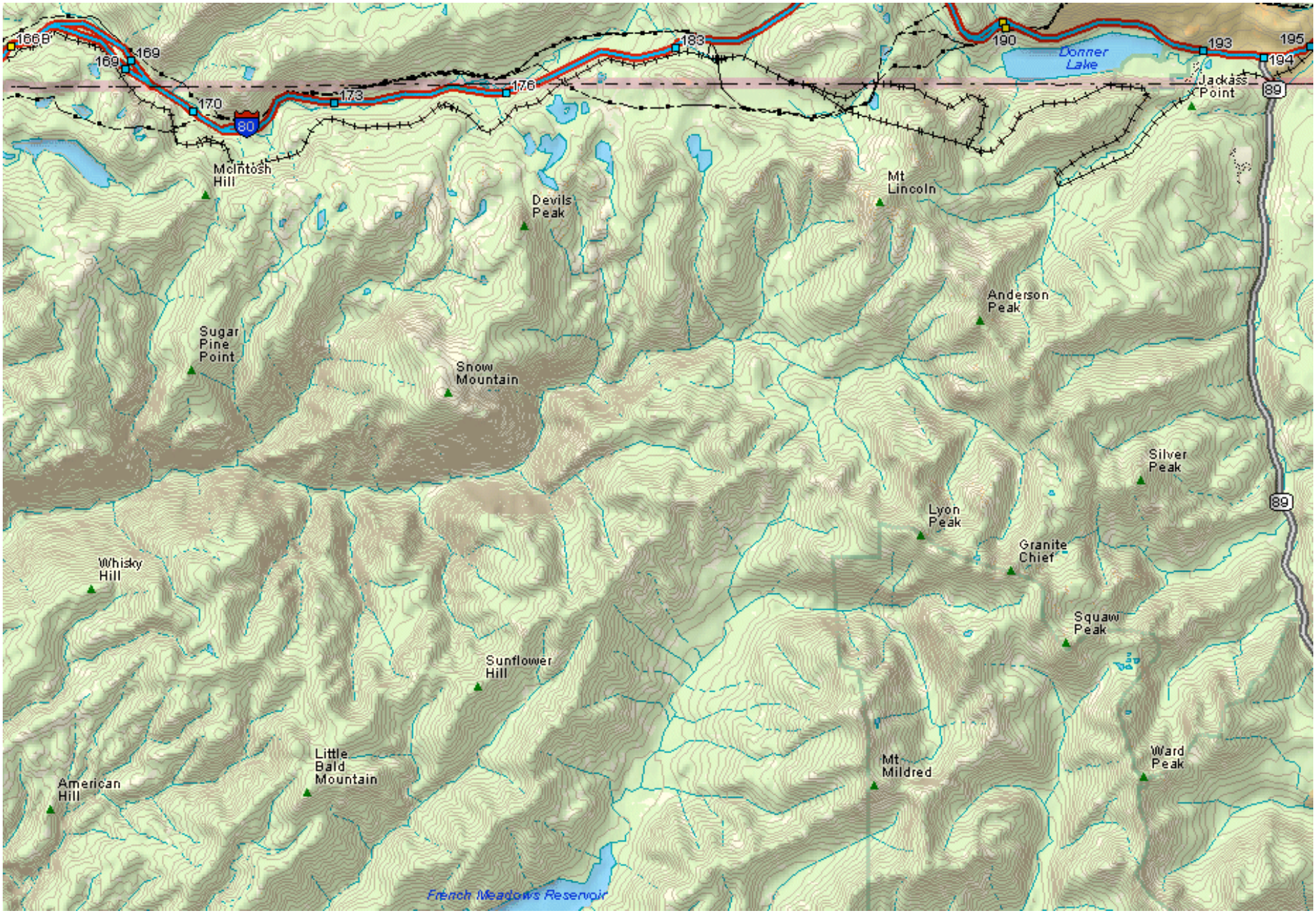
88% at Sacramento



NOAA Hydrometeorological Test Bed -- North Fork American River



NOAA Hydrometeorological Test Bed -- N Fk American River Headwaters




Onion Creek
Experimental Forest
UC Reserve System


Onion Creek
Experimental
Forest
UC Reserve System


Upper North Fork American River


Upper North Fork American River


Mt. Lincoln – Top of Sugar Bowl Ski Area (beyond)

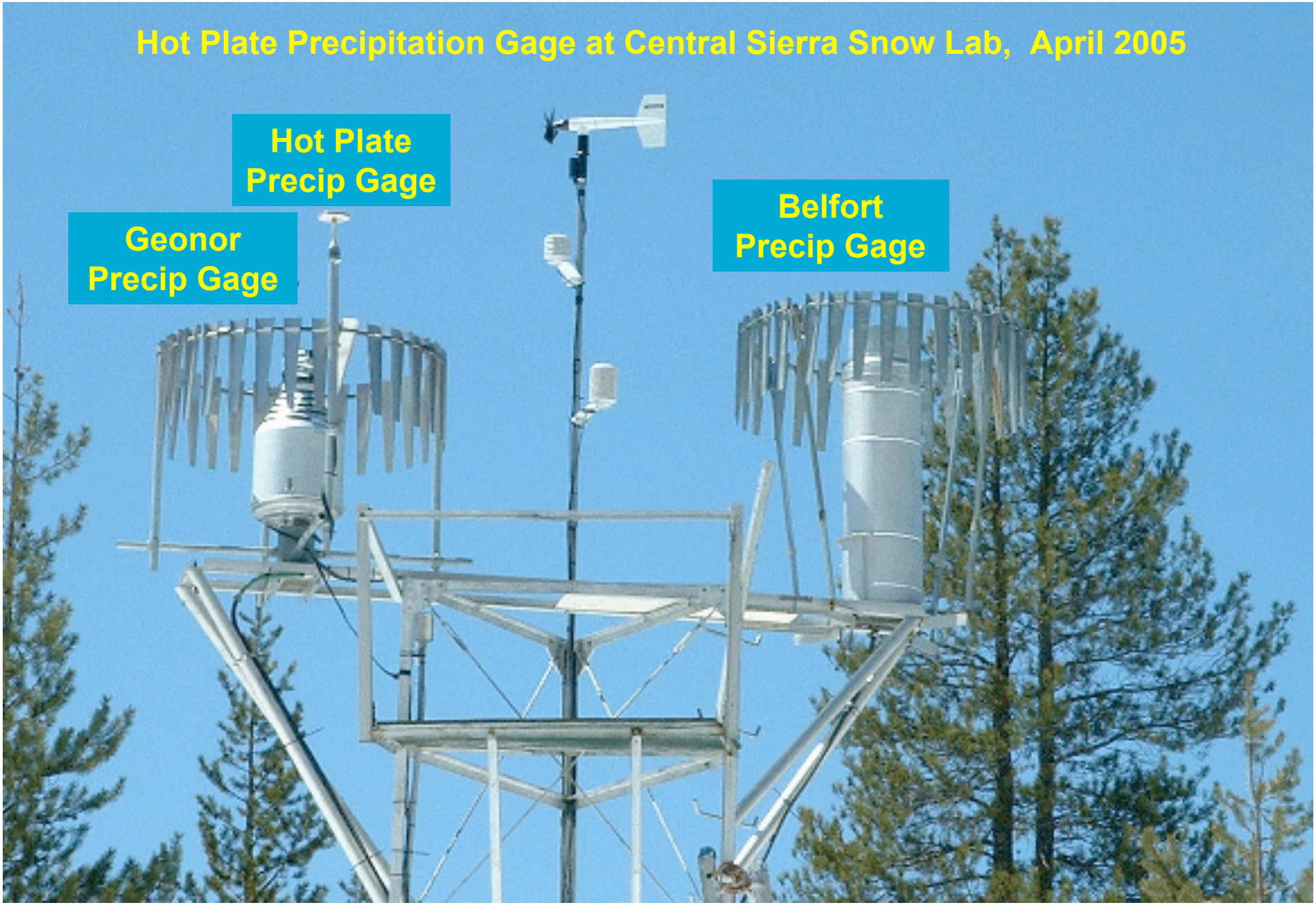
operations? or testing ?

Ice
+
Wind
+
Imbalance
+
Shaking
+
Clouds
+
Battery Discharge
+
Many Hours
=
“Interesting Data”

Ward Peak. Lake Tahoe Basin. 8600 feet.
Photo: Arlen Huggins

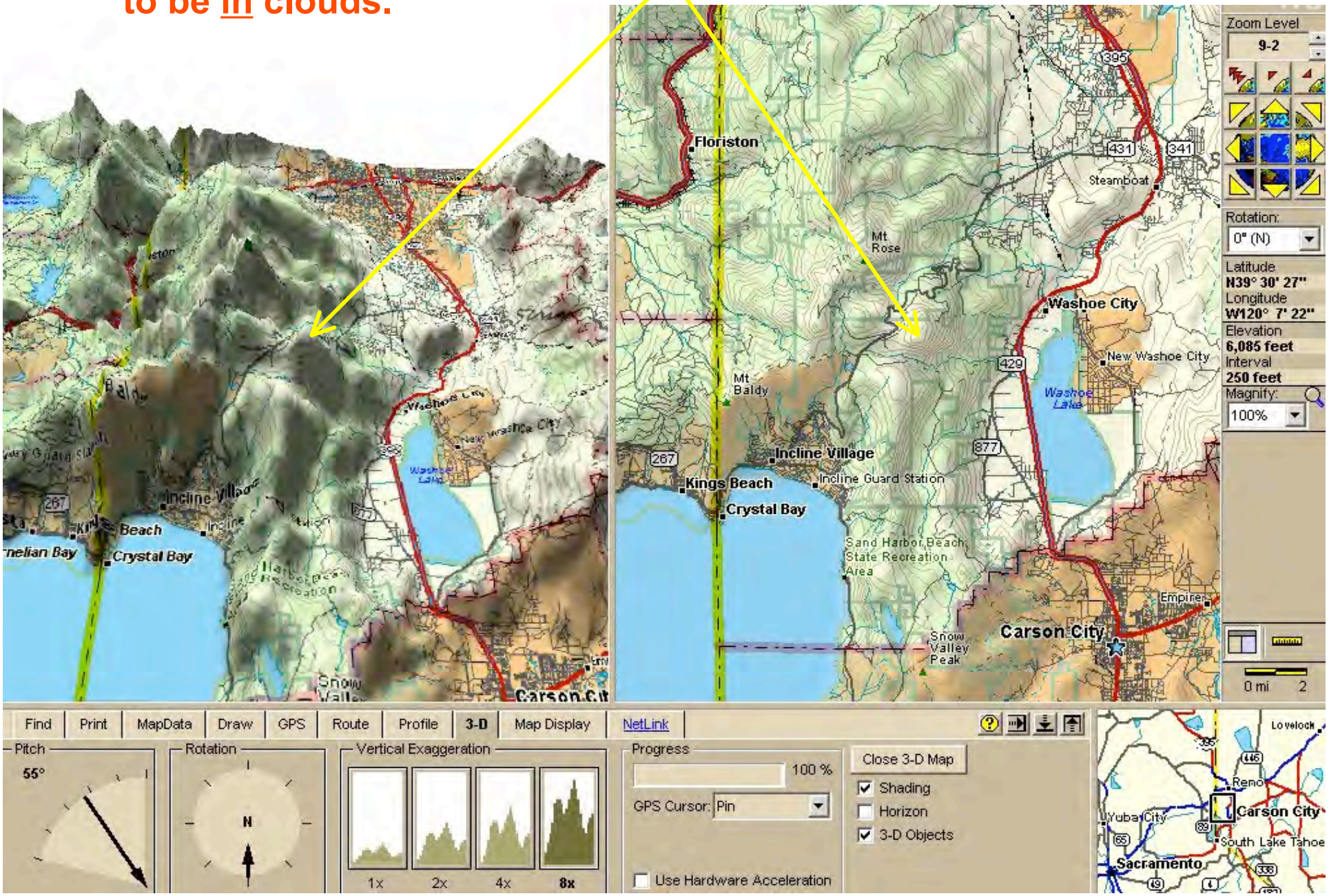
South Central Sierra Snow Lab East

Photo: Dave Simeral


Hot Plate Precipitation Gage at Central Sierra Snow Lab, April 2005
Hot Plate Precip Gage
Geonor Precip Gage
Belfort Precip Gage

Chemists, for example, like to be in clouds.

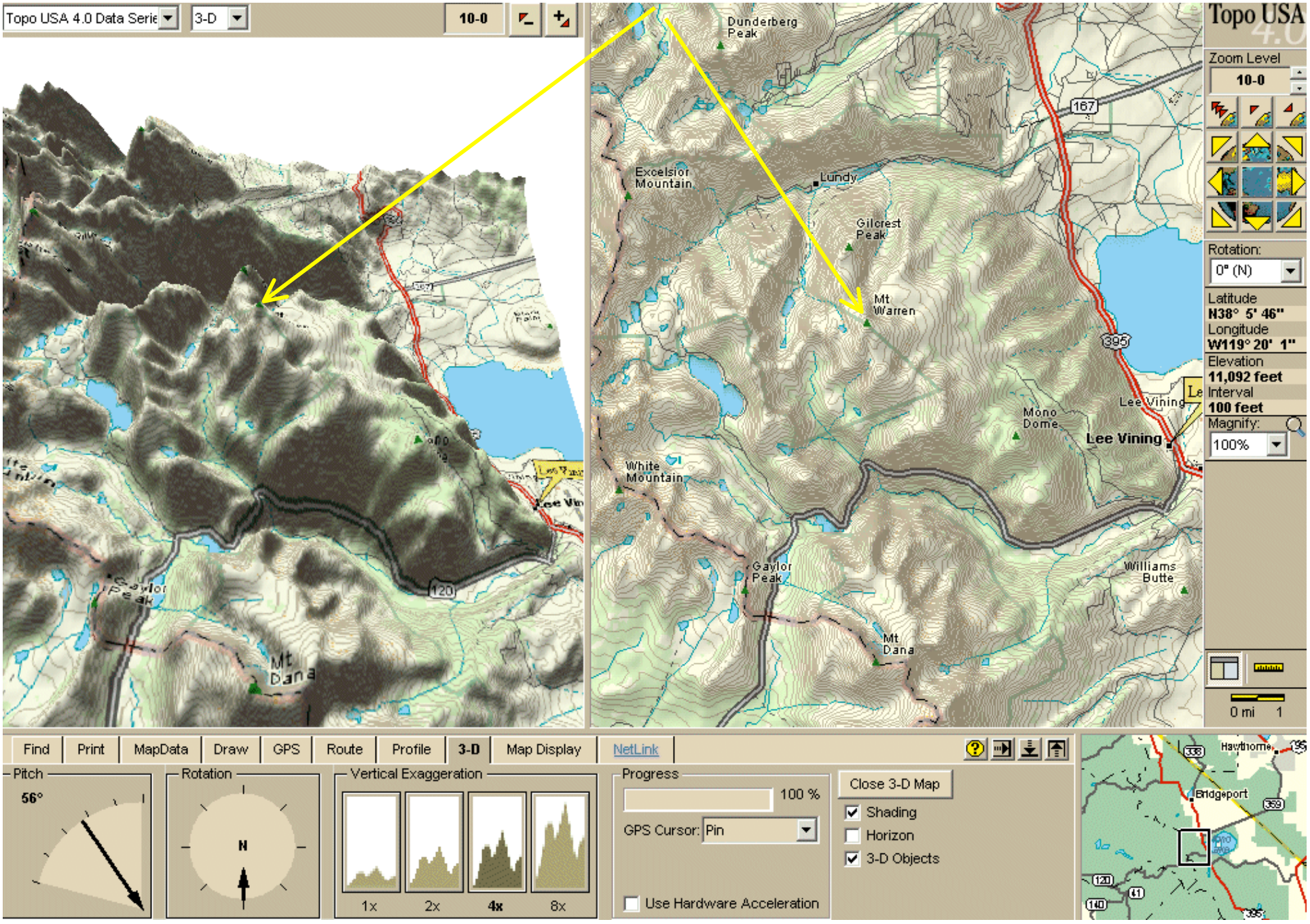
Slide Mountain, Lake Tahoe Basin, 9650 ft.



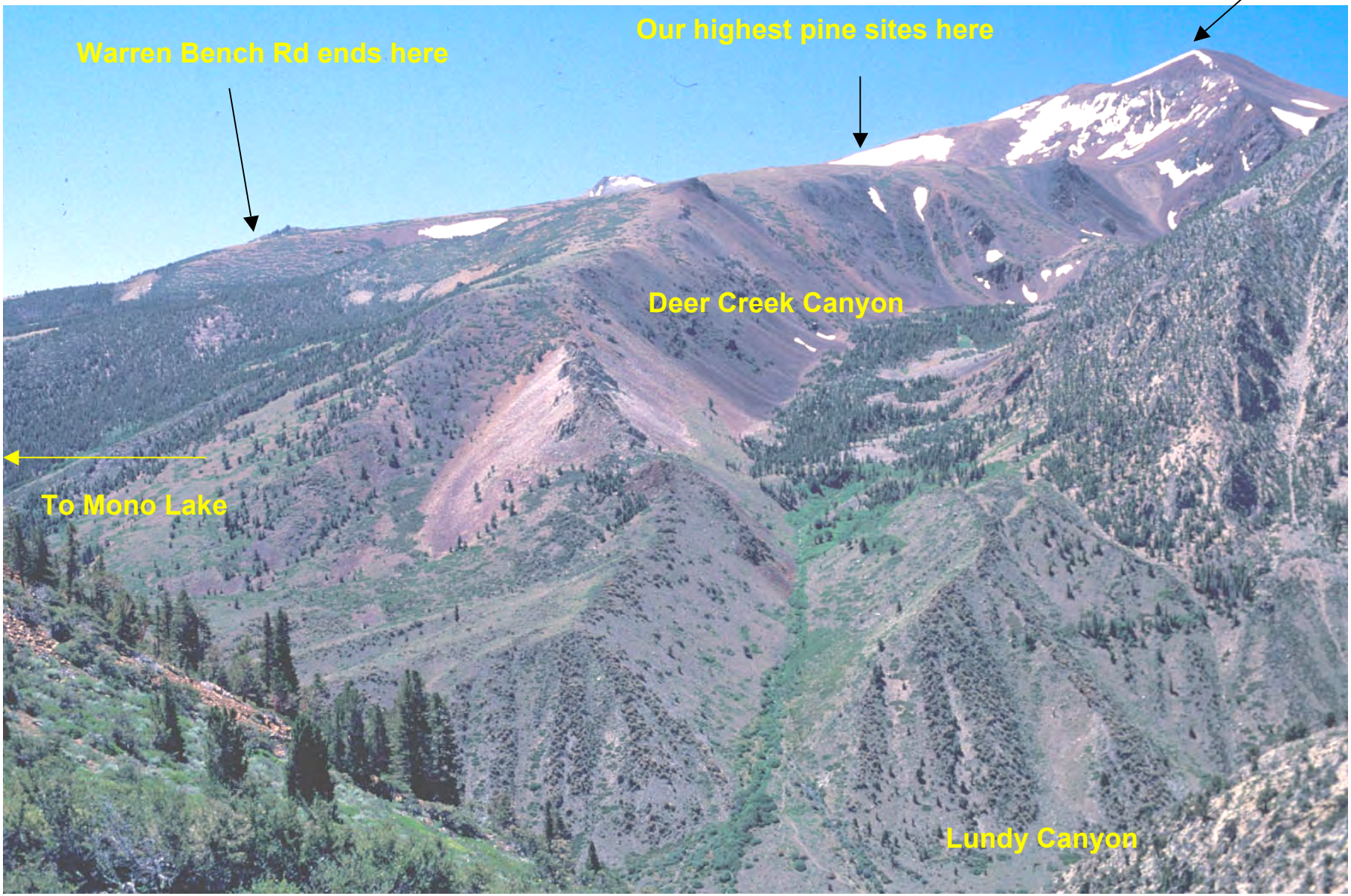

Slide Mountain
Toward SSW


Slide Mountain
Toward NW
Needs AC Power!
Our current mission

Mt Warren


Topo USA 4.0 Data Serie
3-D
10-0
Dunderberg Peak
Excelsior Mountain
Lundy
Gilcrest Peak
Mt Warren
167
395
Lee Vining
Mono Dome
White Mountain
Gaylor Peak
Williams Butte
Mt Dana
120
Topo USA
Zoom Level
10-0
Rotation:
0° (N)
Latitude
N38° 5' 46"
Longitude
W119° 20' 1"
Elevation
11,092 feet
Interval
100 feet
Magnify:
100%
0 mi 1
Find
Print
MapData
Draw
GPS
Route
Profile
3-D
Map Display
NetLink
Pitch
56°
Rotation
N
Vertical Exaggeration
1x
2x
4x
8x
Progress
100 %
GPS Cursor: Pin
Use Hardware Acceleration
Close 3-D Map
Shading
Horizon
3-D Objects
Haythorne
Bridgeport
120
41
140
395

Mt Warren (12327 ft) Toward South. July 2000.



View looking south up Deer Cr (NB: beautiful Pleistocene Rock Glacial cyn), a tributary of Lundy Cyn (note also limber pines at left foreslope (one of our sites). 7/00

Photo: Connie Millar


White Mtn Summit
Reconfigured July 2004

Trinidad Head


Shelter Cove


Point Arena

Potential Long Term Climate Monitoring Sites


Antenna West and East sites.

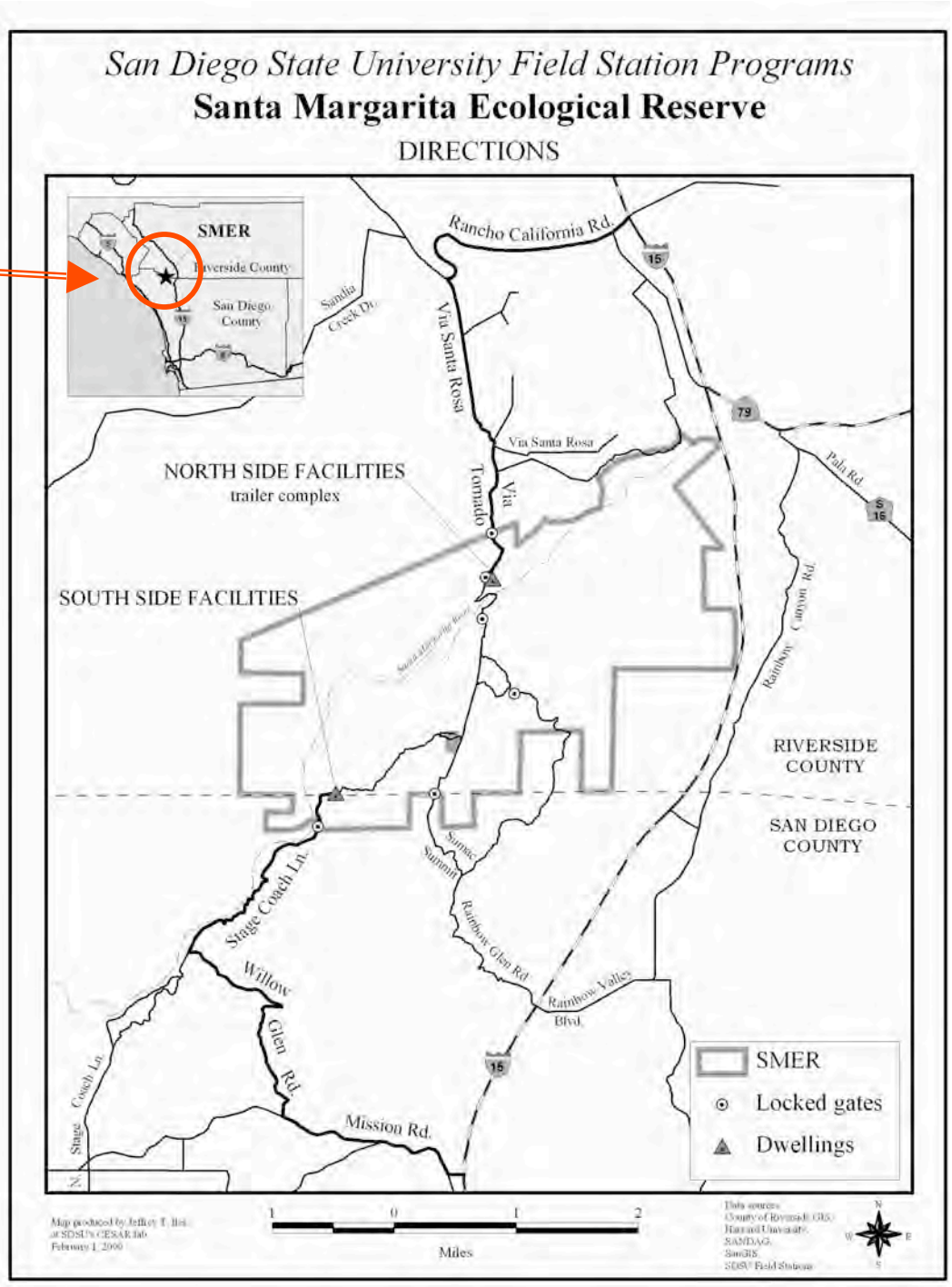

Antenna West and East sites.


HILLS
CURVES
NEXT
63 MILES


Point Sur

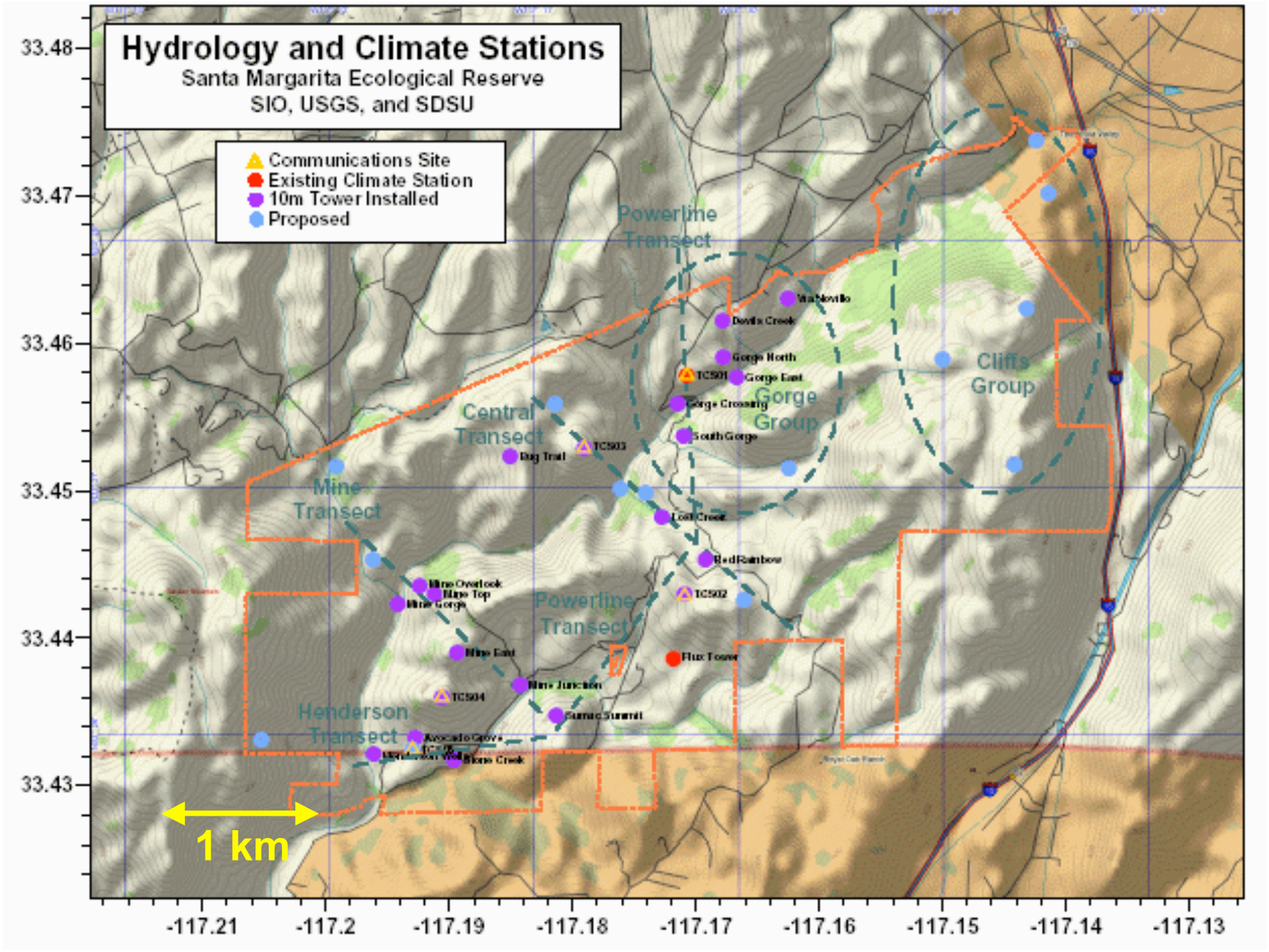

Big Sur


Big Sur



UCSD:

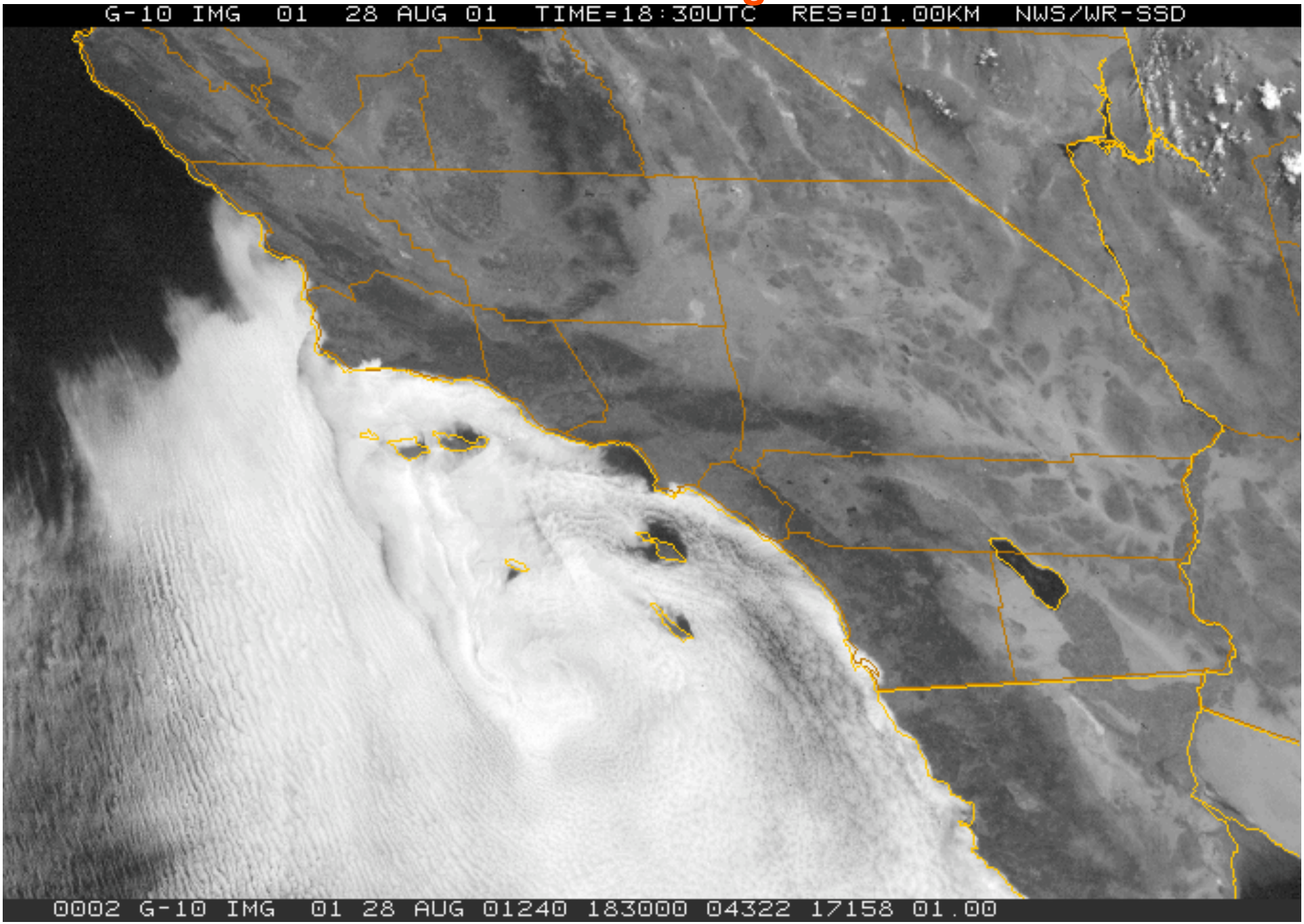
Santa Margarita Ecological Reserve


Hydrology and Climate Stations
Santa Margarita Ecological Reserve
SIO, USGS, and SDSU
Communications Site
Existing Climate Station
10m Tower Installed
Proposed
Powerline Transect
Central Transect
Mine Transect
Powerline Transect
Henderson Transect
Gorge Group
Cliffs Group
Devils Creek
Gorge North
Gorge East
Gorge Crossing
South Gorge
Dog Trail
Lost Creek
Red Rainbow
Mine Overlook
Mine Top
Mine Gorge
Mine East
Mine Junction
Sumac Summit
Flux Tower
Avocado Grove
Stone Creek
TC501
TC502
TC503
TC504
1 km
33.48
33.47
33.46
33.45
33.44
33.43
-117.21
-117.2
-117.19
-117.18
-117.17
-117.16
-117.15
-117.14
-117.13

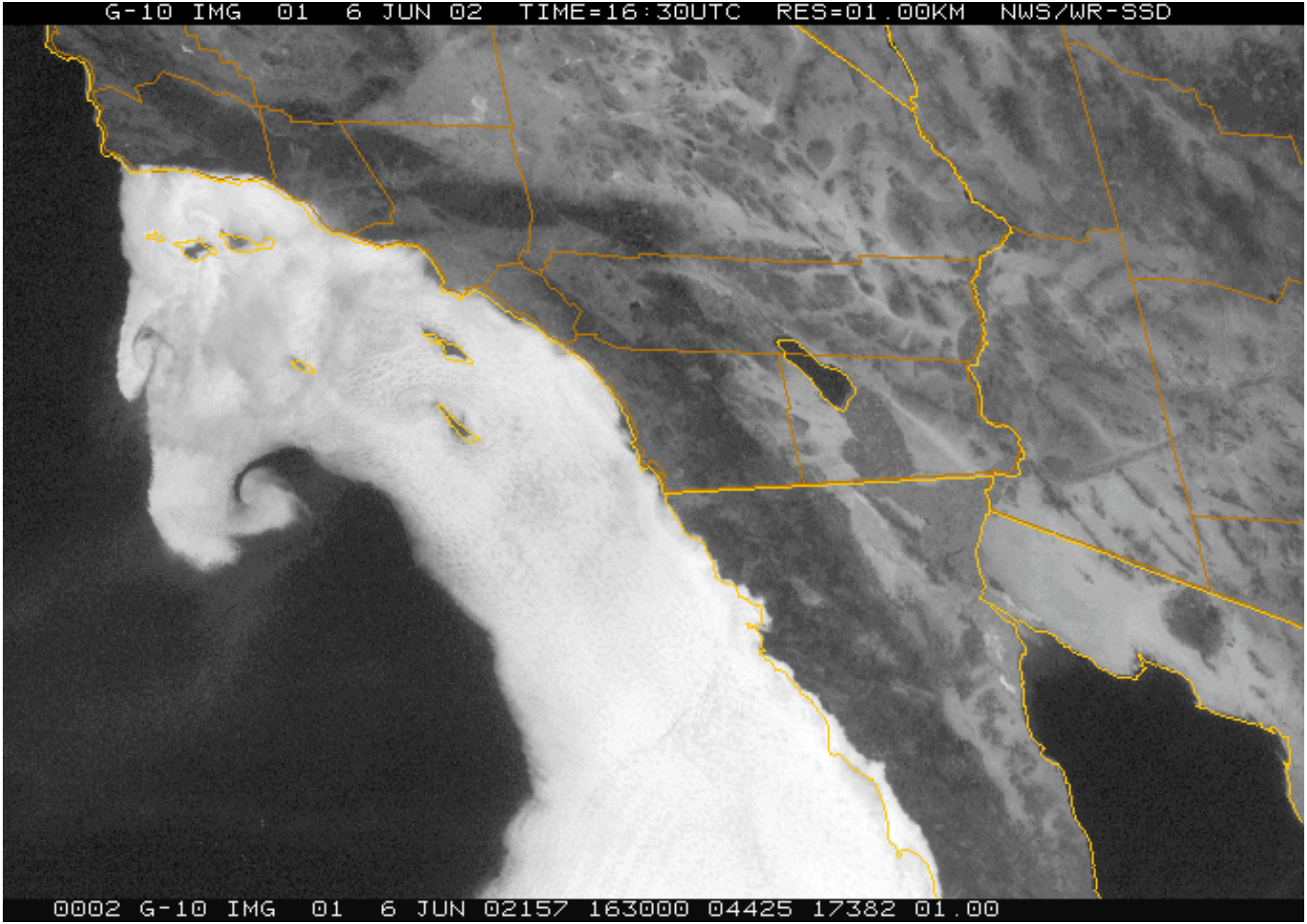

1925

The coastal climate is complicated and subtle:

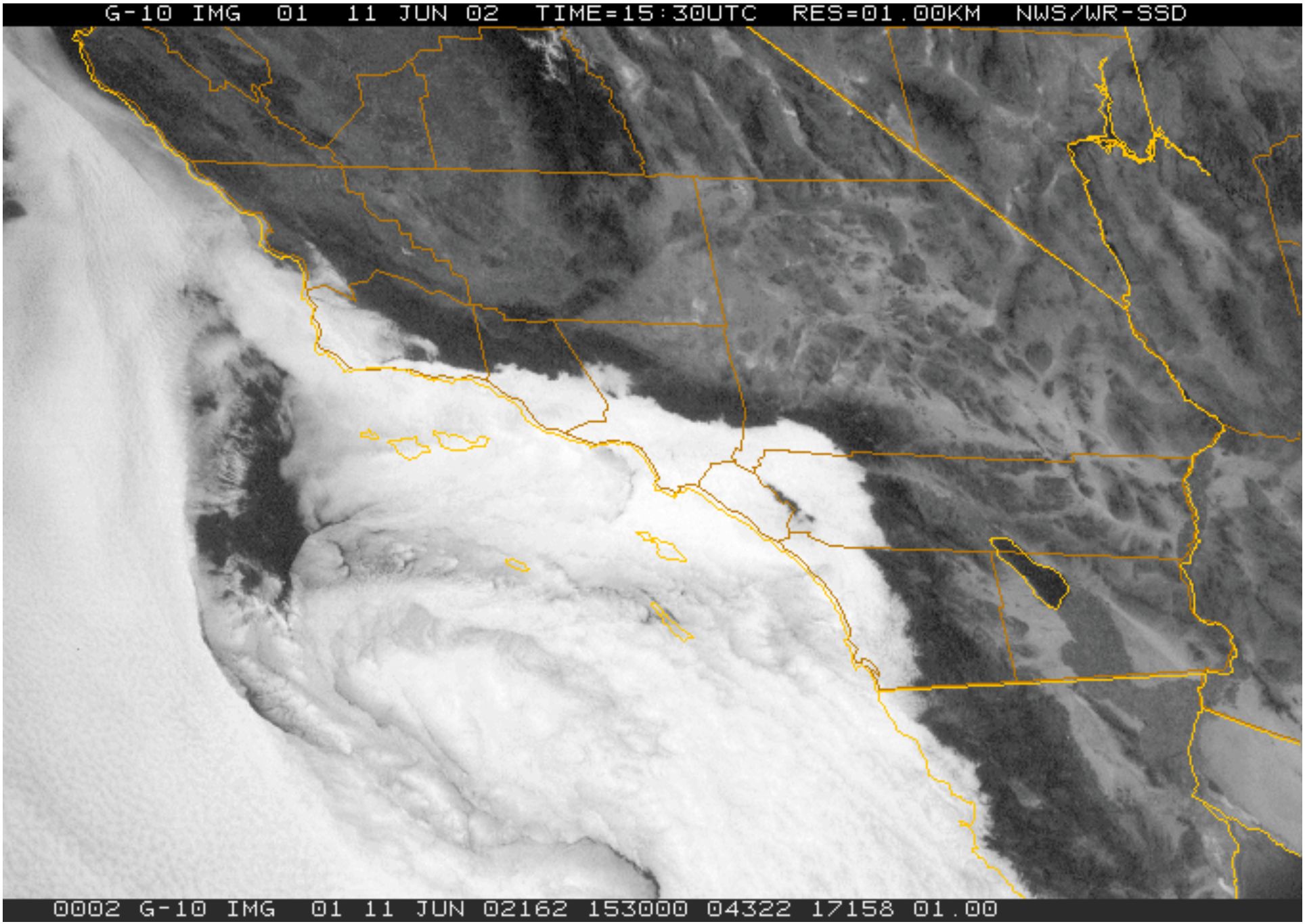
1830 GMT 28 Aug 2001



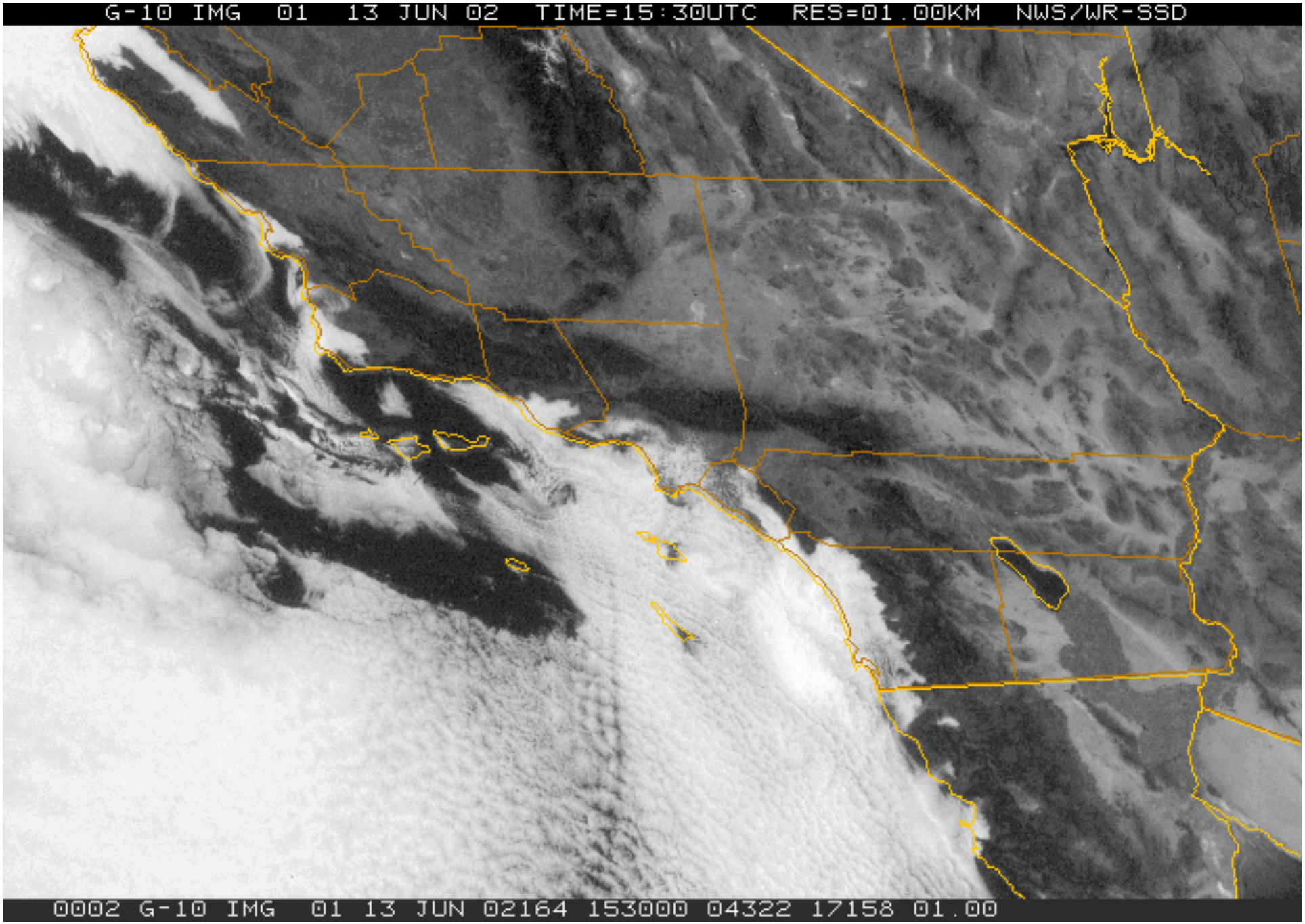
1630 GMT 06 Jun 2002



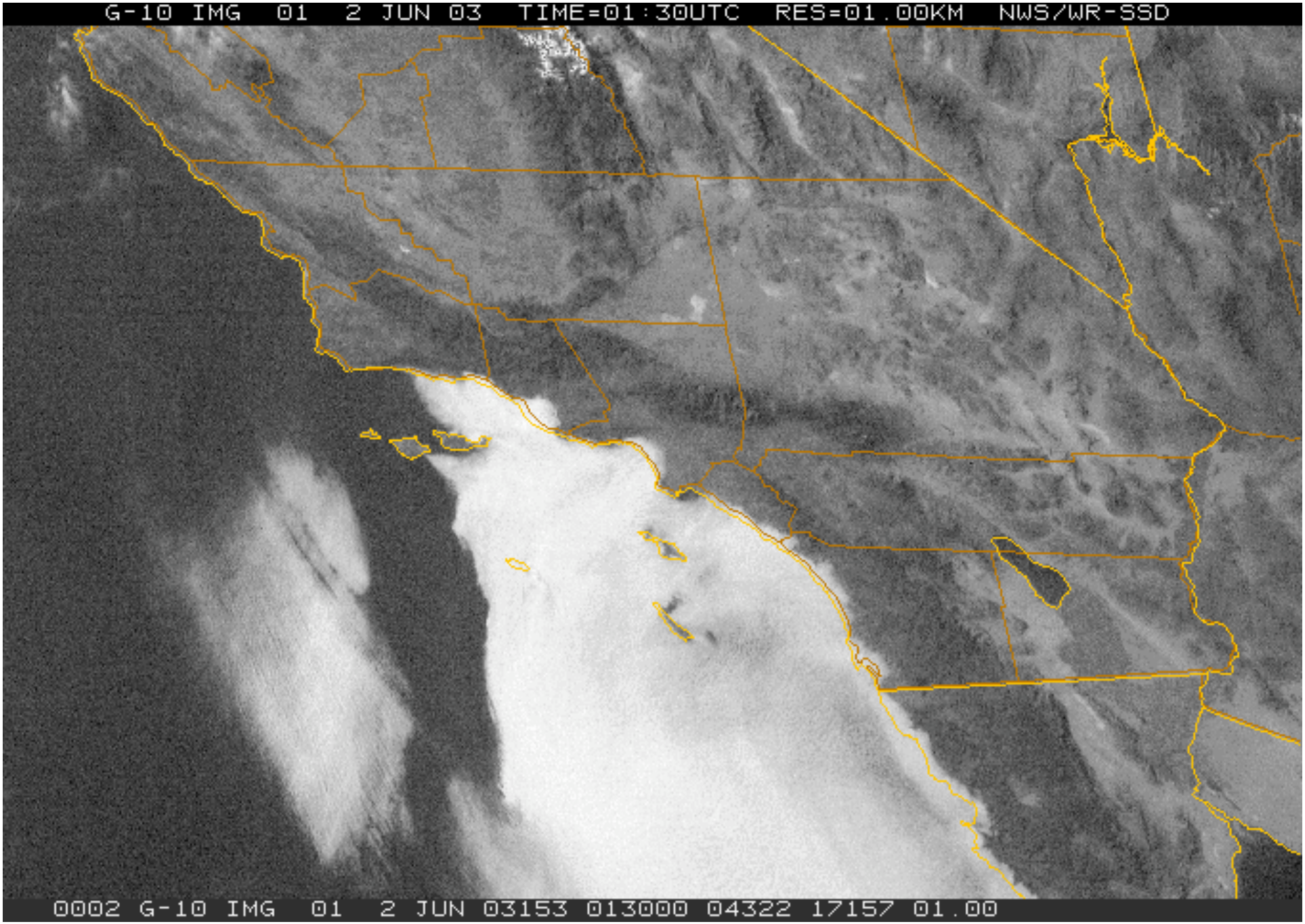
1530 GMT 11 Jun 2002



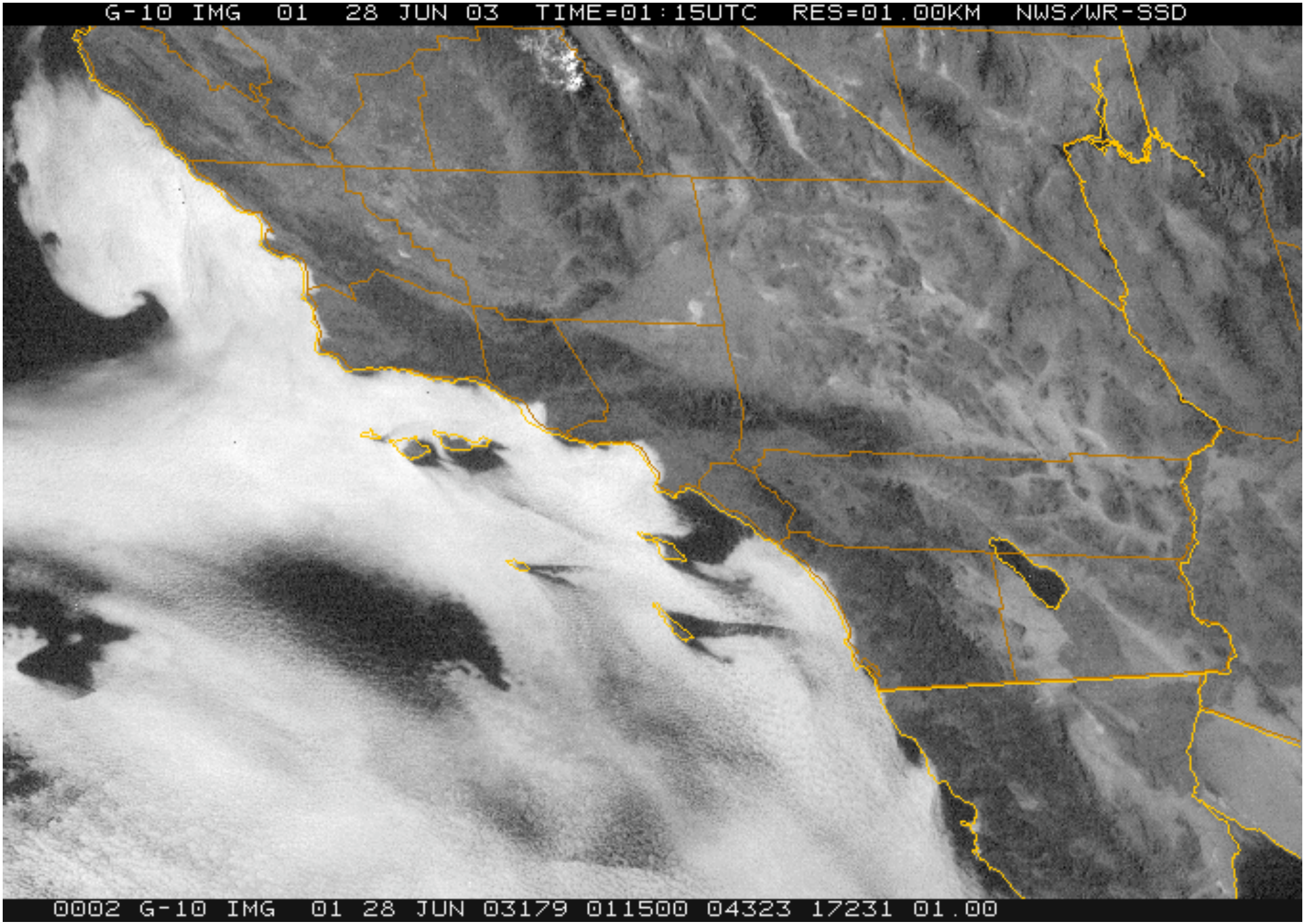
1530 GMT 13 Jun 2002



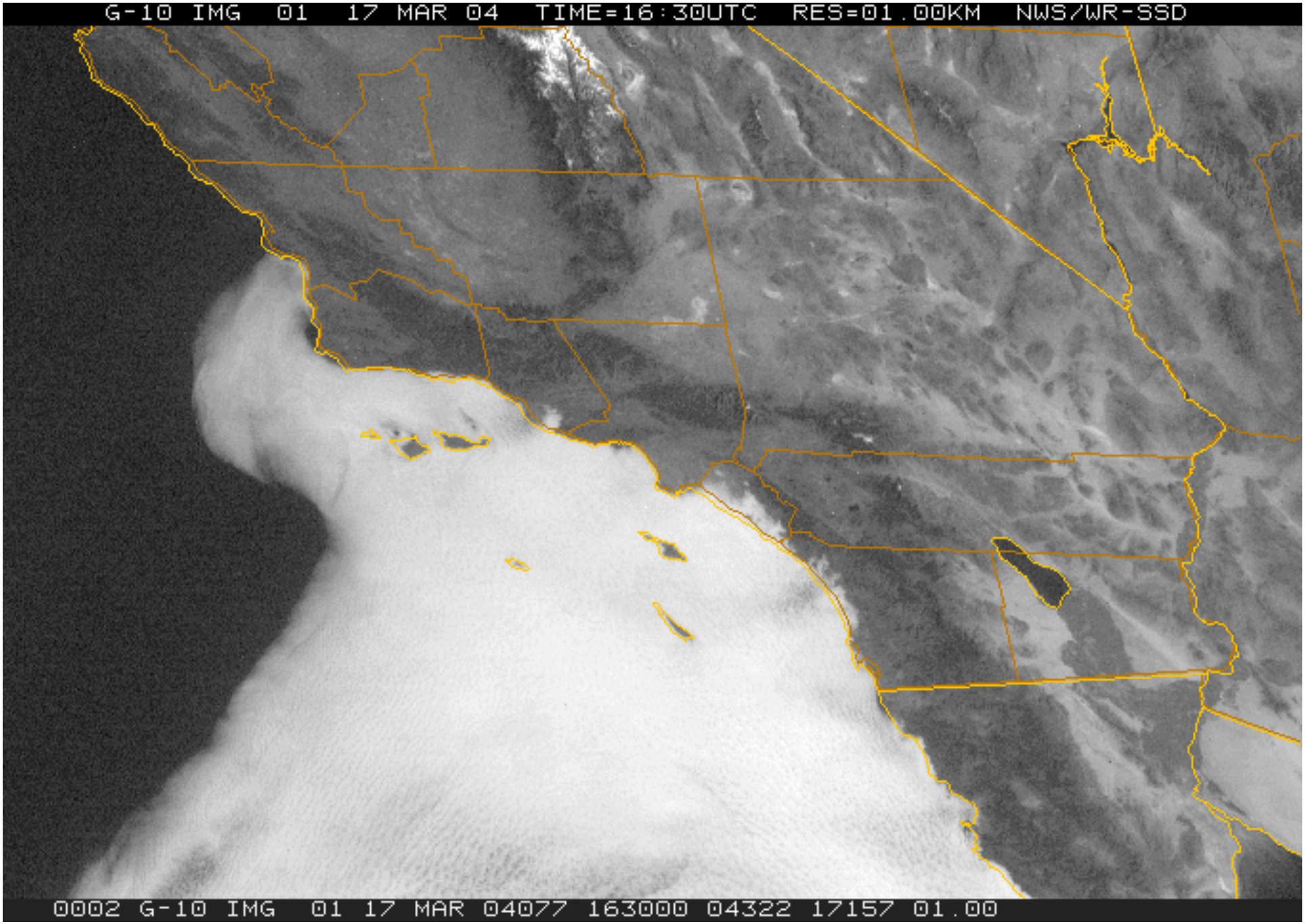
0130 GMT 2 Jun 2003



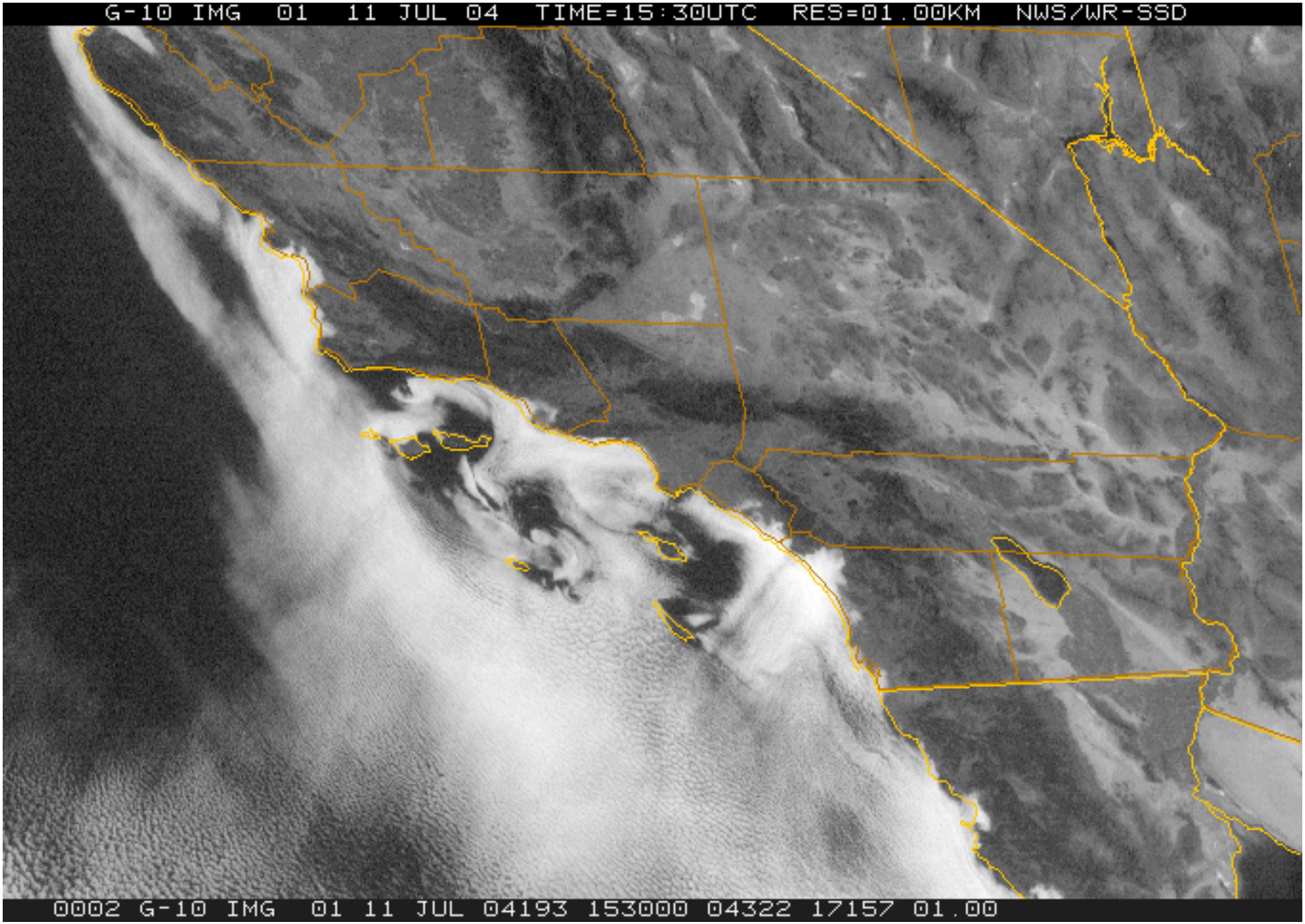
0115 GMT 28 Jun 2003



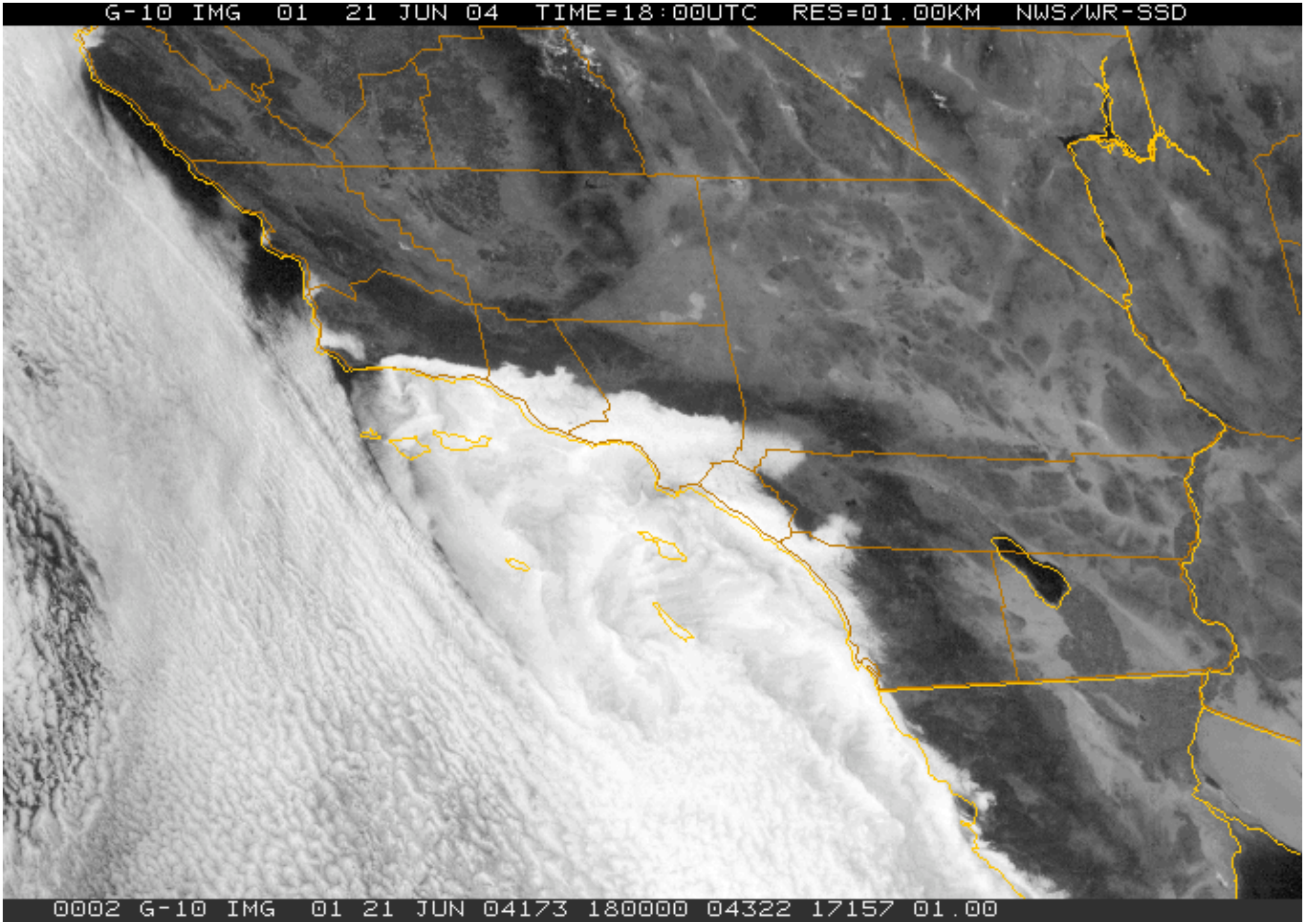
1630 GMT 17 Mar 2004



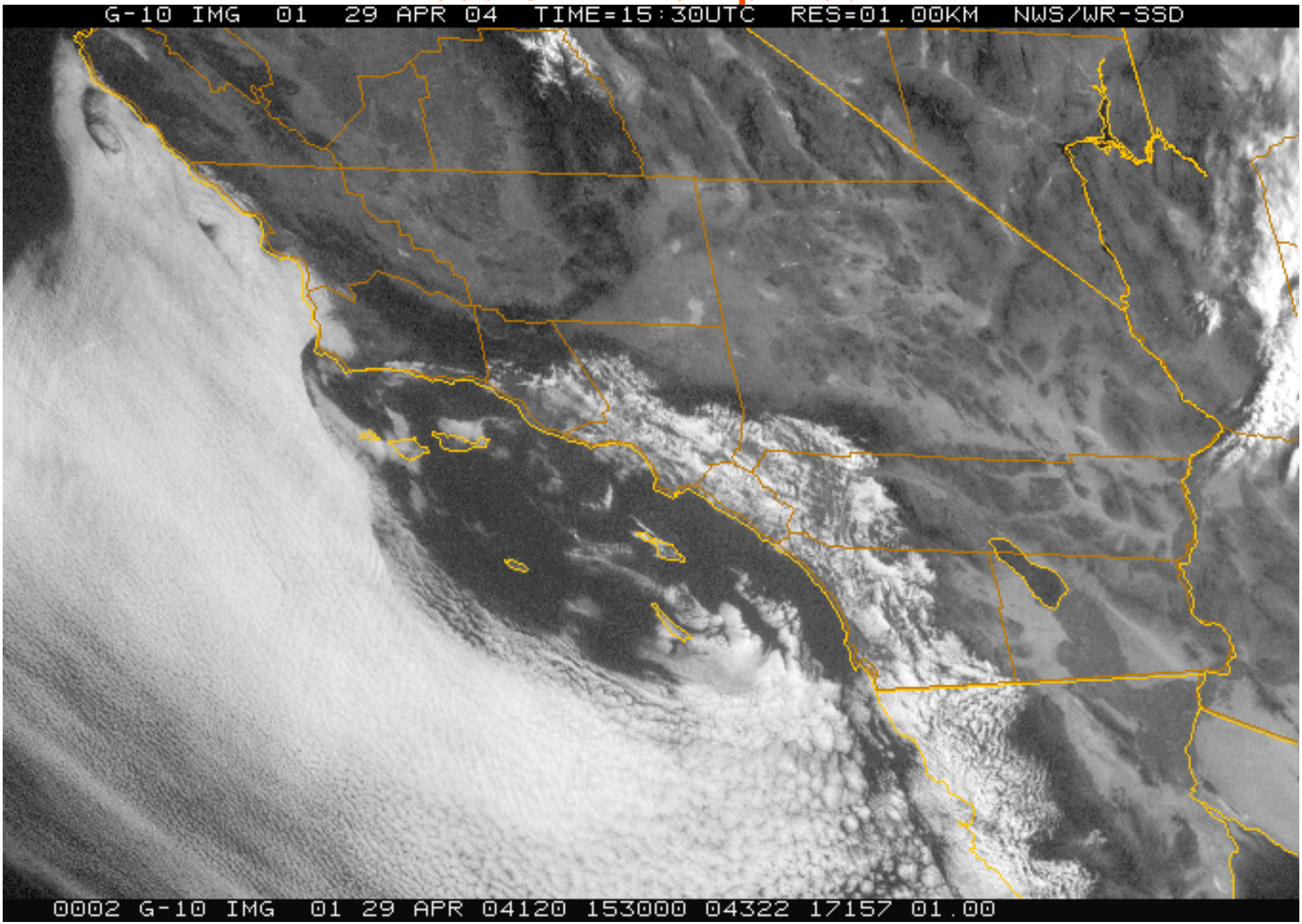
1530 GMT 11 Jul 2004



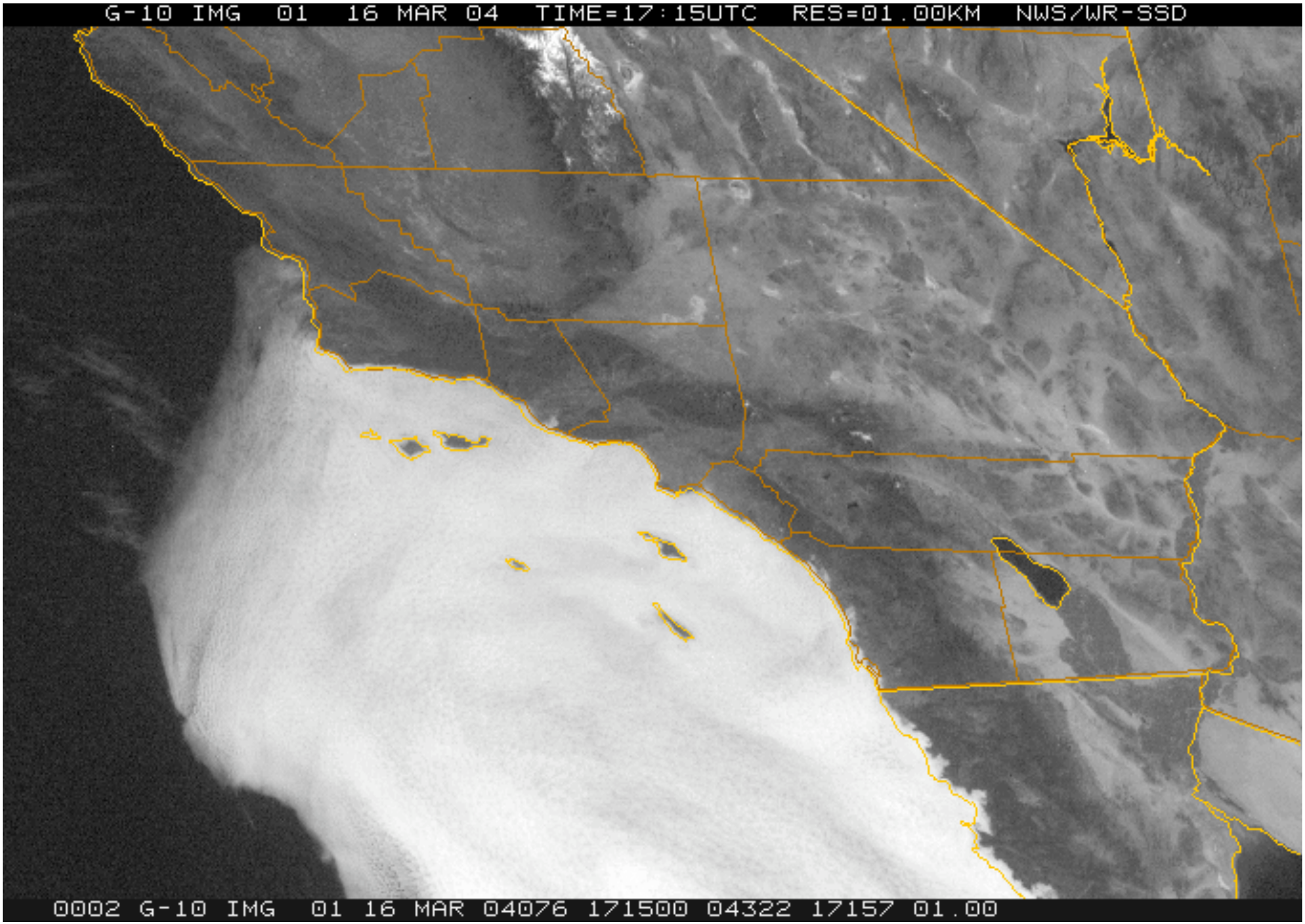
1800 GMT 21 Jun 2004



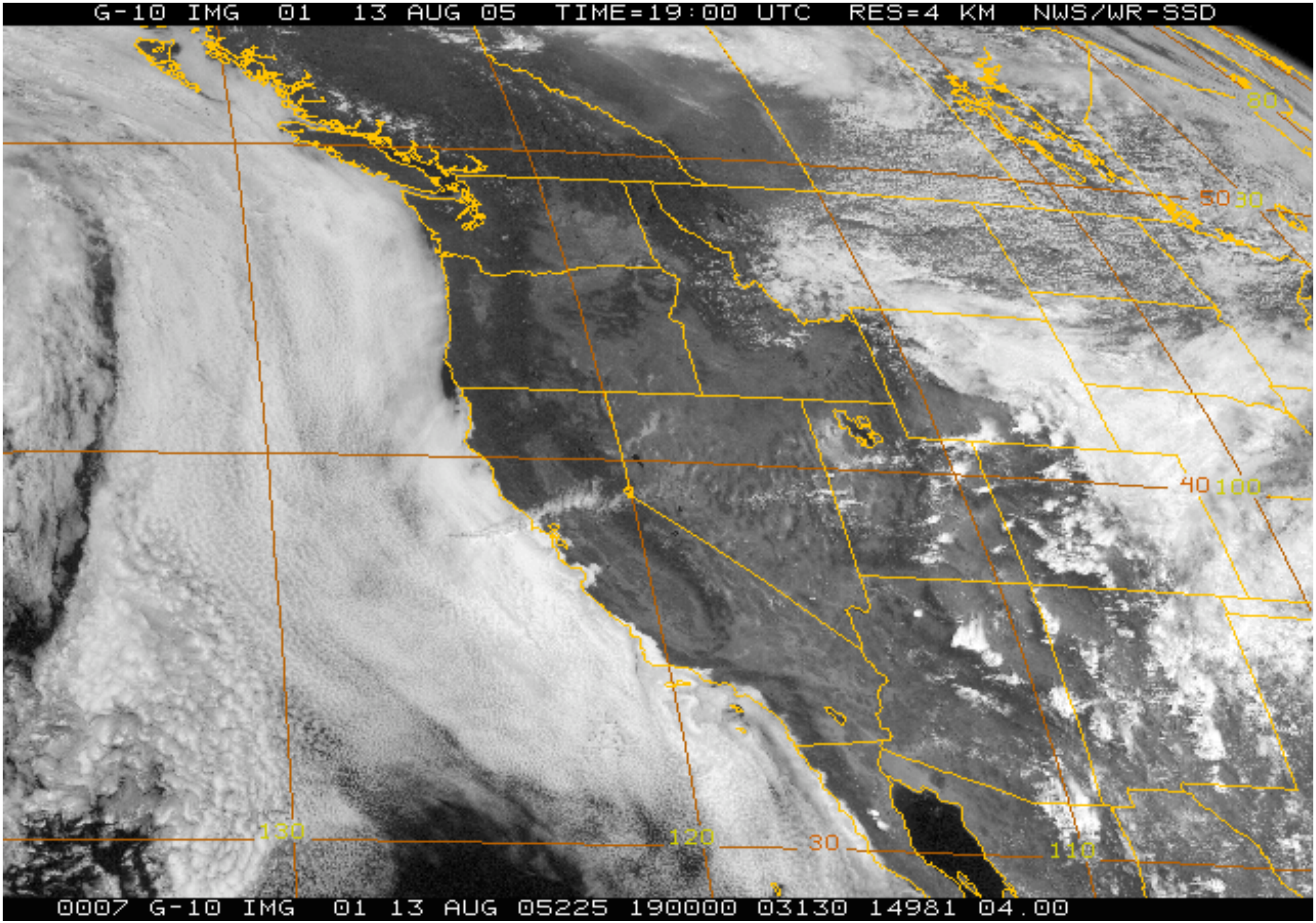
1530 GMT 29 Apr 2004



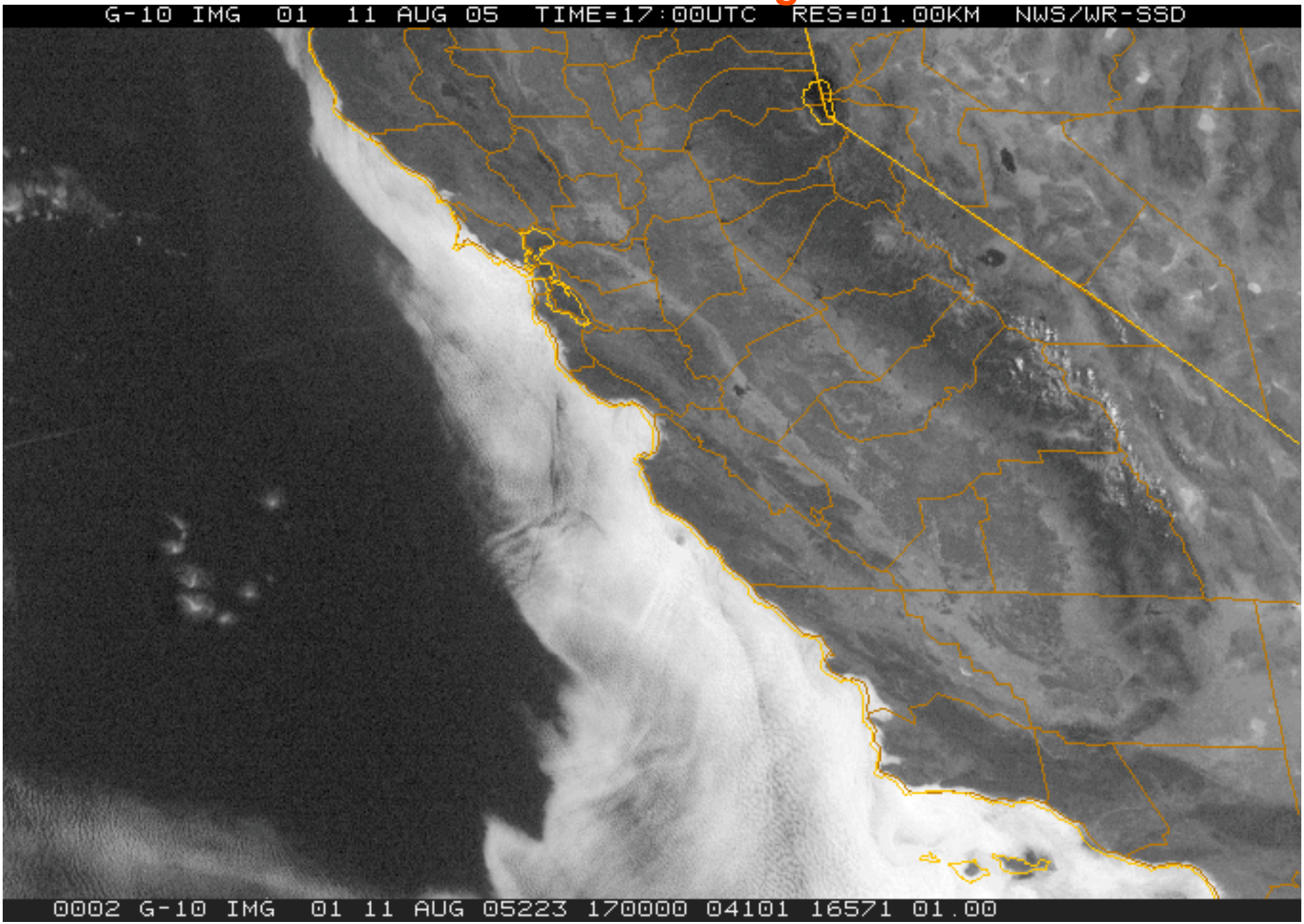
1715 GMT 16 Mar 2004



1900 GMT 13 Aug 2005



1700 GMT 11 Aug 2005



ECCM Strategy as of September 2005

Special California CRN stations appear to be too expensive for ECCM

One or two transects from the near shore ocean to far western Great Basin.

Augment selected Sierra mountaintops.

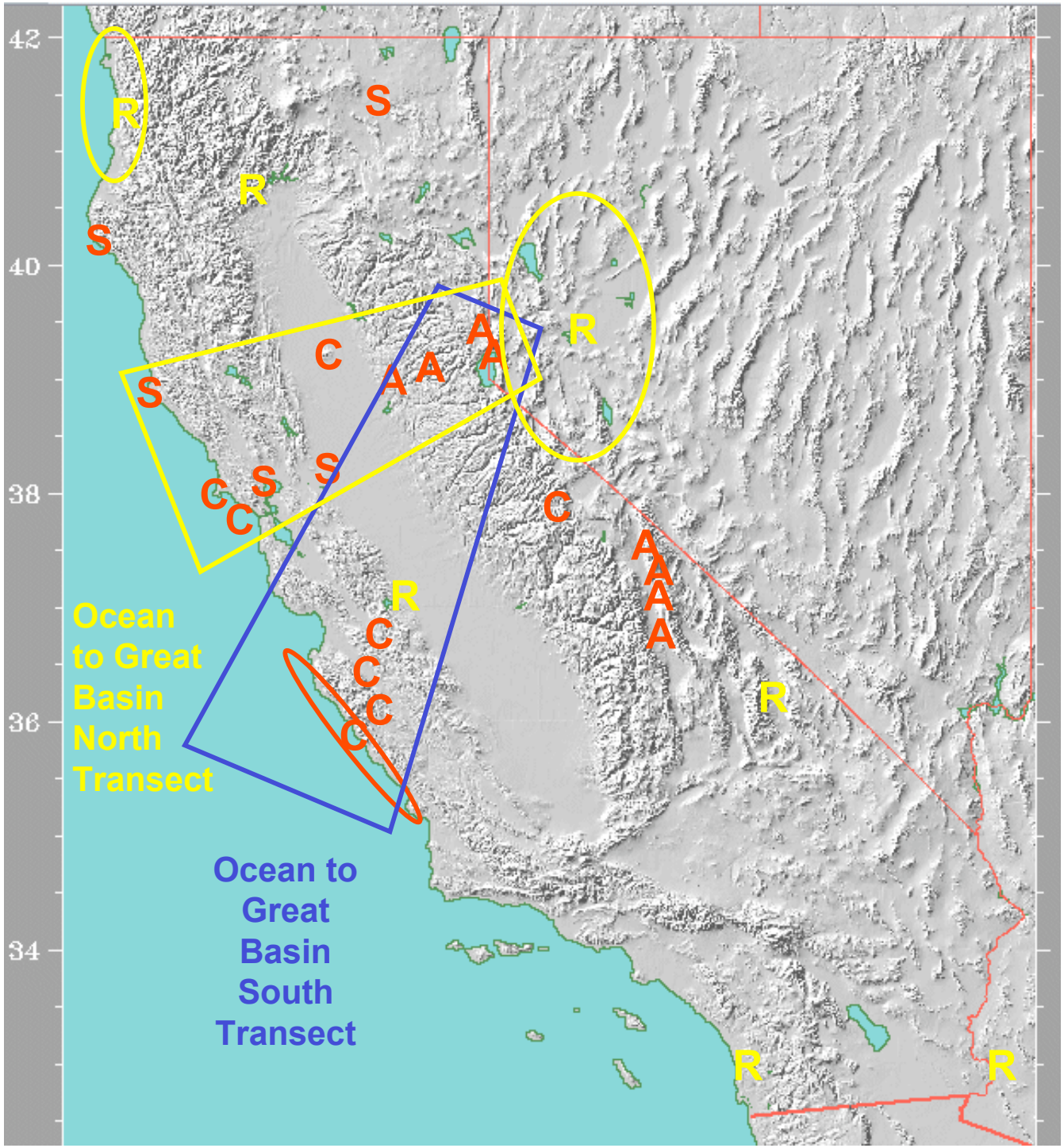
Leverage other current and planned projects.

R – Existing or "expected" national CRN

C – Potential New California Climate Monitoring Site

A – Potential Augmentation Site

S – Additional sites of opportunity



Contact information

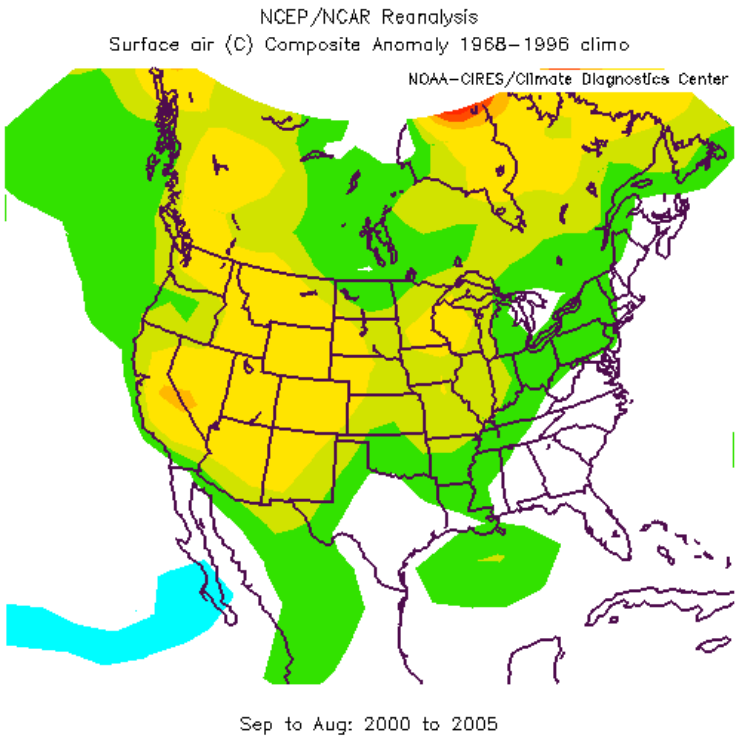
Kelly Redmond
Regional Climatologist
Western Regional Climate Center
775-674-7011 voice
775-674-7016 fax
kelly.redmond@dri.edu
www.wrcc.dri.edu

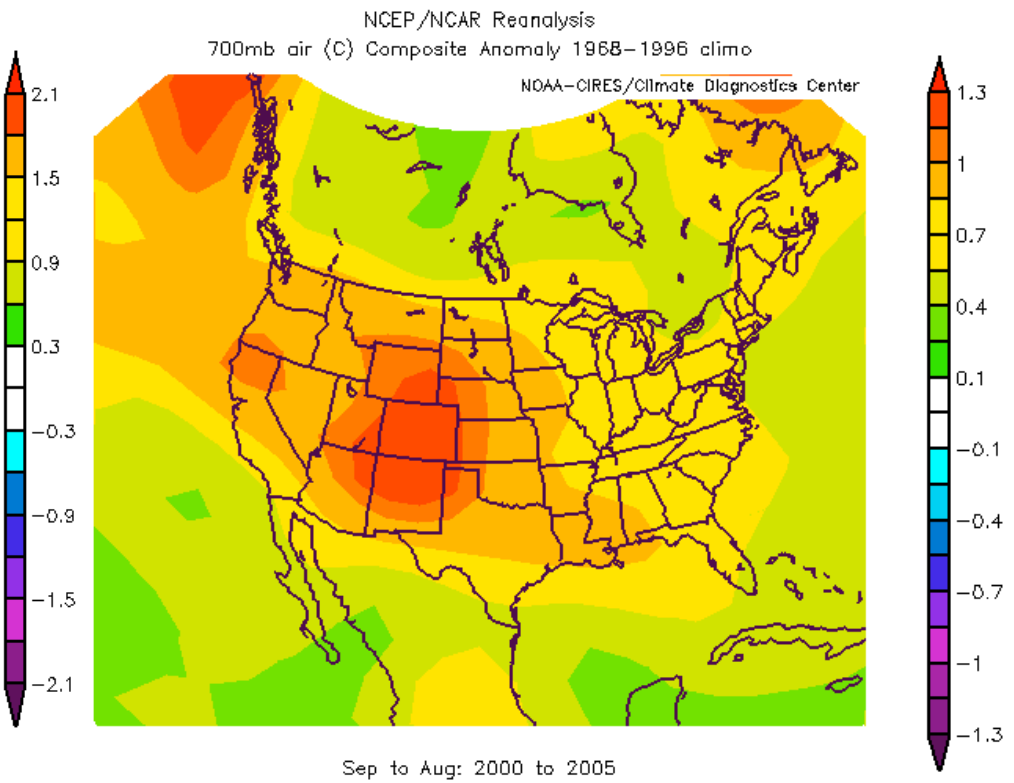
Calclim

Laura Edwards
California Climate Specialist
Western Regional Climate Center
775-674-7163 voice
775-674-7016 fax
laura.edwards@dri.edu
www.calclim.dri.edu

Thank You

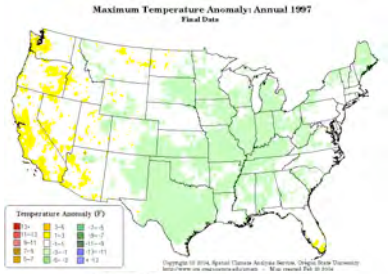
Spares and discards after this

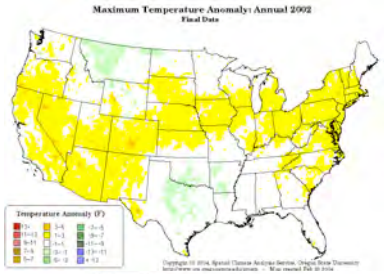


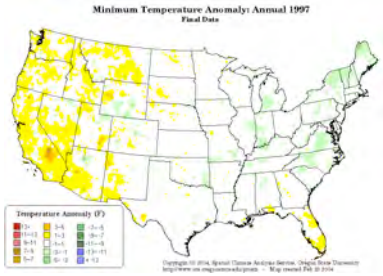


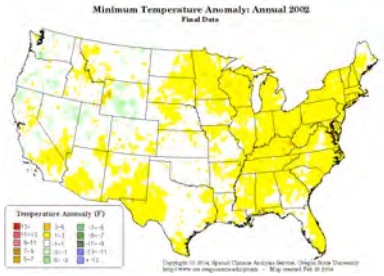
September thru August
1999-01 / 2004-05
Surface Temperature Dep
NCEP/NCAR Reanalysis

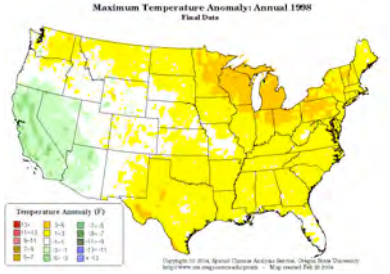
September thru August
1999-01 / 2004-05
700 mb Temperature Dep
NCEP/NCAR Reanalysis

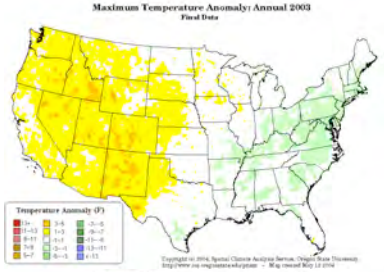


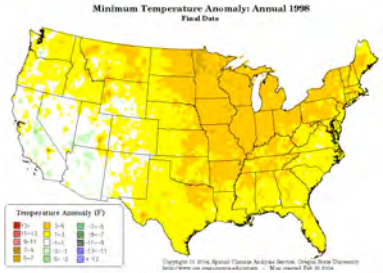


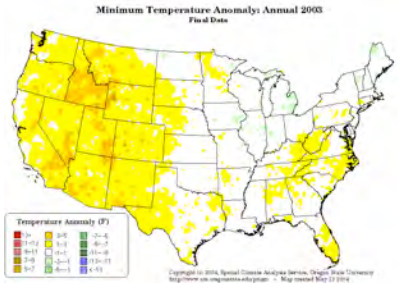


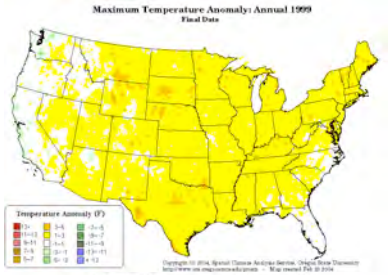


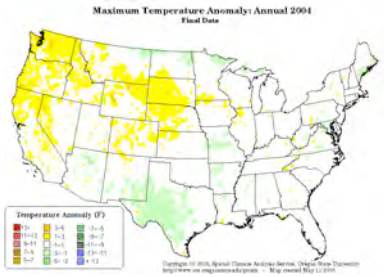


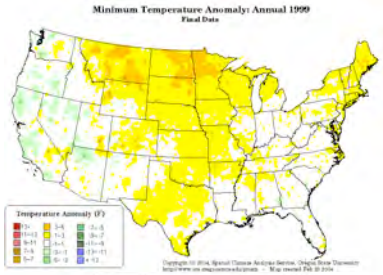


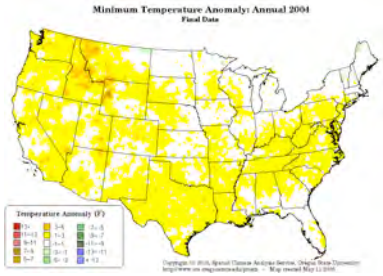


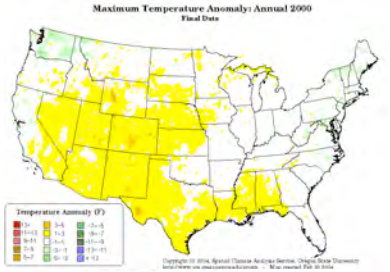


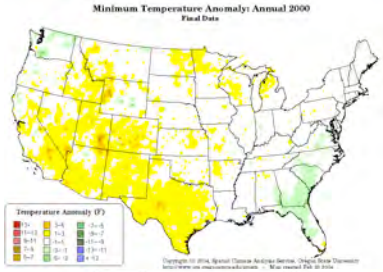


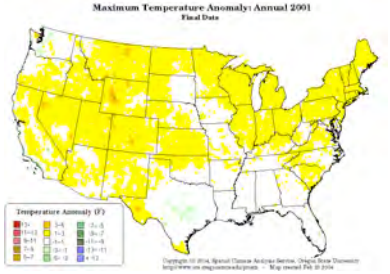


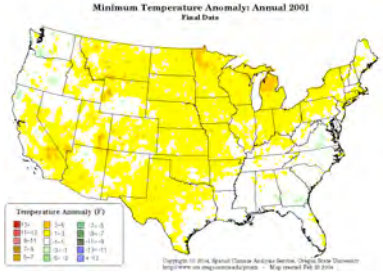










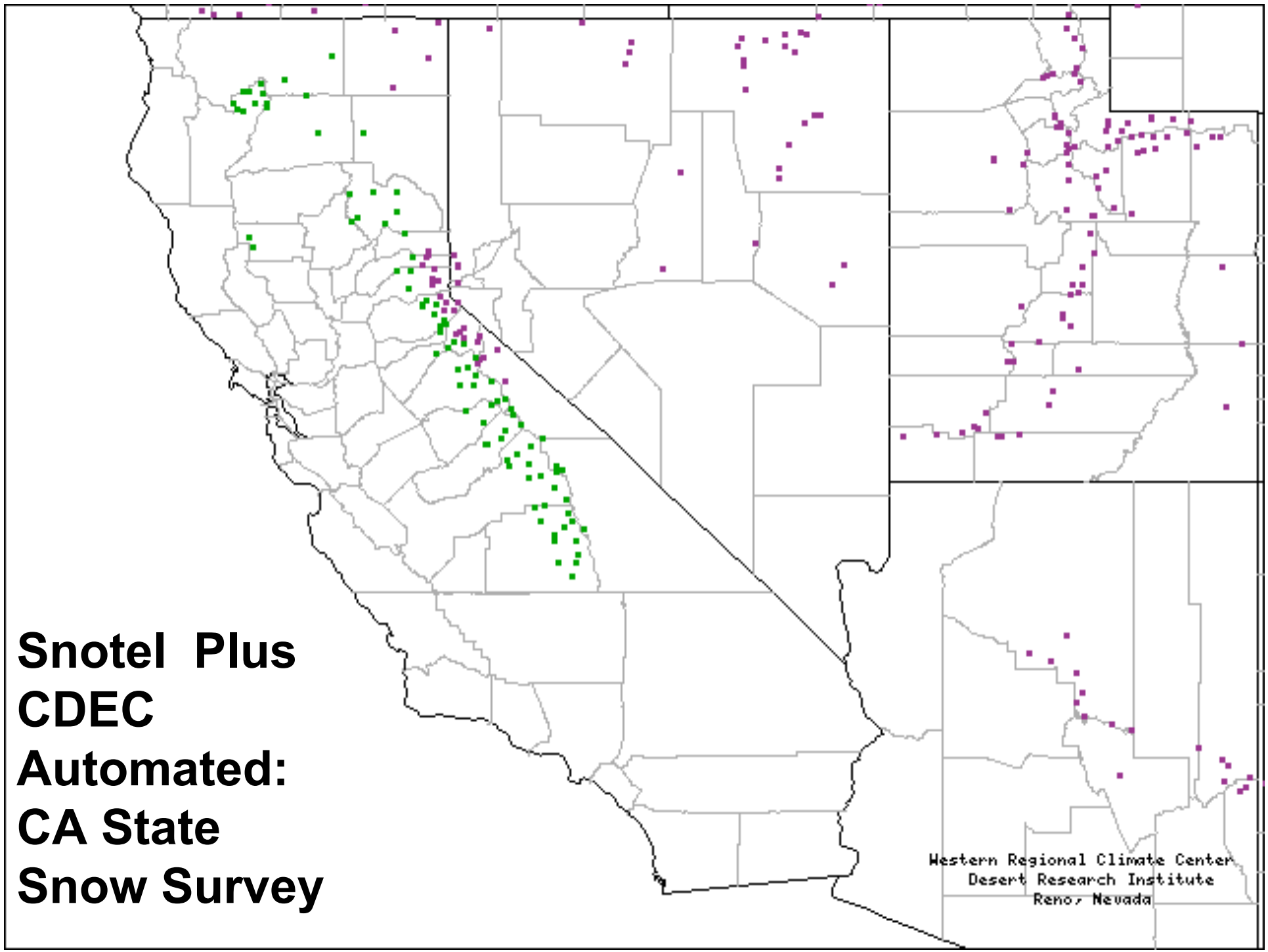


Annual Max Temp Dep

1997	2002	PRISM
1998	2003	
1999	2004	
2000		
2001		

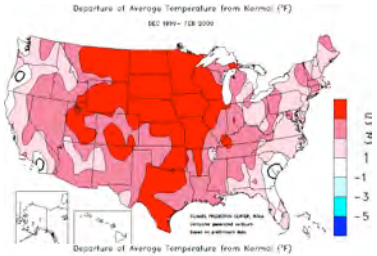
Annual Min Temp Dep

1997	2002	PRISM
1998	2003	
1999	2004	
2000		
2001		

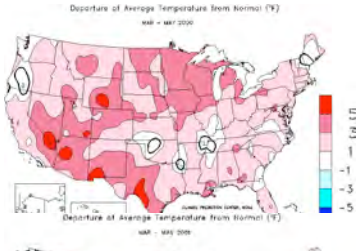

Snotel Plus
CDEC
Automated:
CA State
Snow Survey
Western Regional Climate Center
Desert Research Institute
Reno, Nevada

Partners

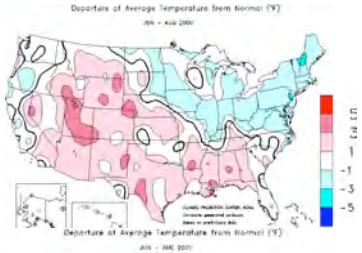
- California Climate Change Center
  - Scripps Climate Research Division
- California Department of Water Resources
  - Division of Flood Management
  - California Snow Survey
  - California Data Exchange Center
- National Oceanic and Atmospheric Administration
  - NWS Weather Forecast Offices
  - NWS River Forecast Center
  - NOAA climate/marine/research agencies
- State Climate Office (UC/DWR)
- California Energy Commission
- UC universities, and UC reserve system



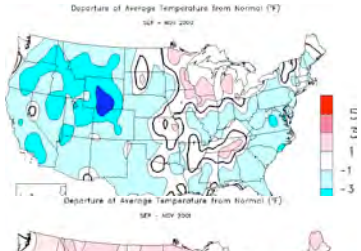
Wi 00



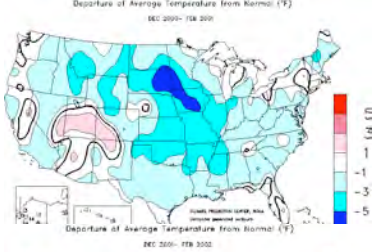
Sp 00



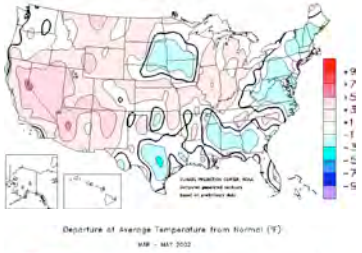
Su 00



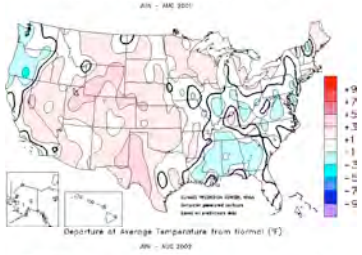
Au 00



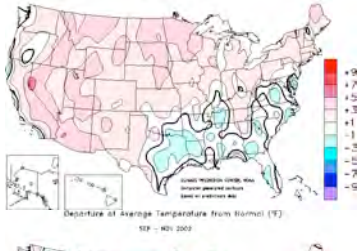
Wi 01



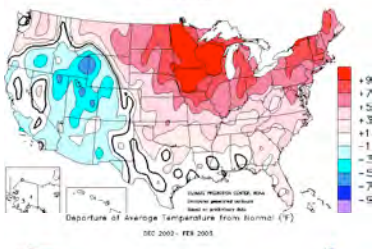
Sp 01



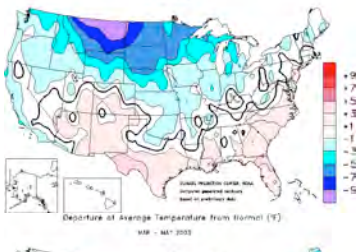
Su 01



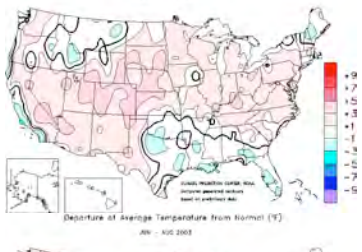
Au 01



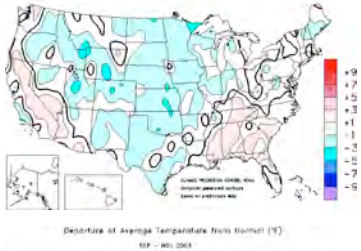
Wi 02



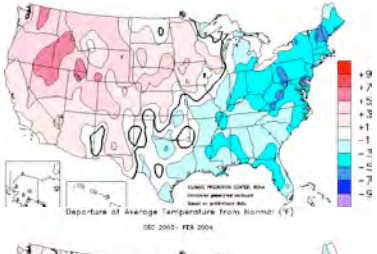
Sp 02



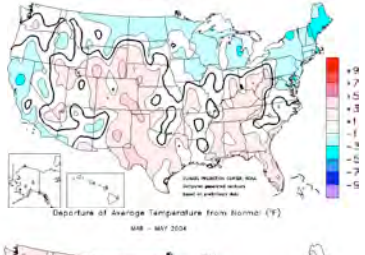
Su 02



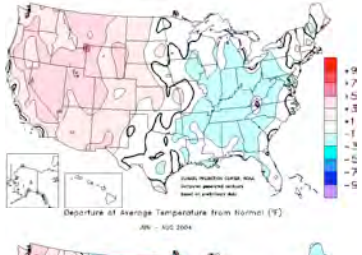
Au 02



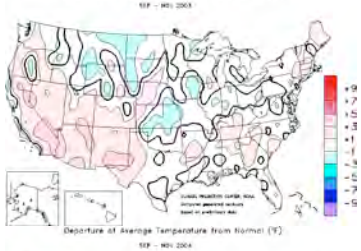
Wi 03



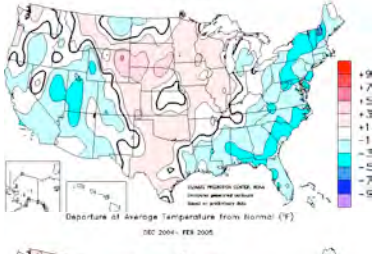
Sp 03



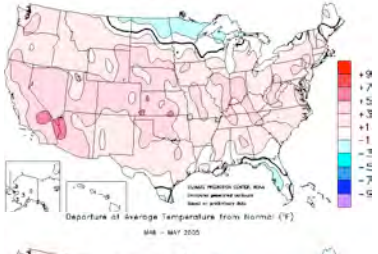
Su 03



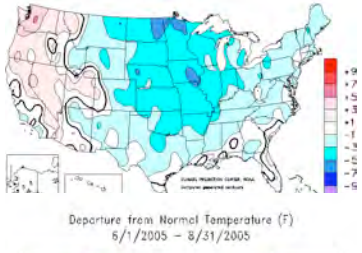
Au 03



Wi 04

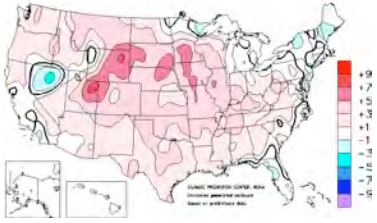


Sp 04

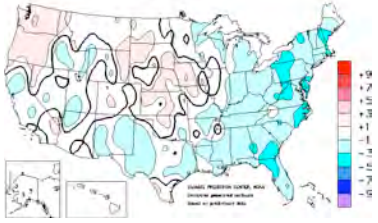


Su 04

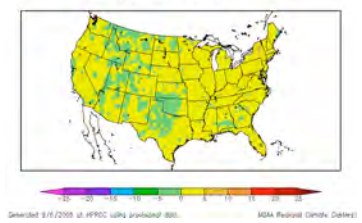
Au 04



Wi 05



Sp 05



Su 05

ACIS

USDA / NOAA
JAWF / CPC

Daily Summary for

Prev Day **June 16, 2005** Next Day

Station	Wind Ave. mph	Wind V. Dir. Deg	Wind Max. mph	Air Temperature Mean Deg. F.	Air Temperature Max Deg. F.	Air Temperature Min Deg. F.	Humidity Mean Percent	Humidity Max Percent	Humidity Min Percent	Dew Point Deg. F.	Wet Bulb Deg. F.	Baro. Press. in. Hg.	Battery Voltage Mean volts	Battery Voltage Max volts	Battery Voltage Min volts
SR #1	10.2	231	52.8	68.7	80.9	58.0	18	30	10	23	47	24.24	12.8	13.2	12.3
SR #2	8.4	240	48.1	72.2	84.7	59.6	16	28	10	23	48	24.99	12.7	13.2	12.2
SR #3	8.8	265	42.9	74.2	88.5	58.5	17	32	9	25	50	25.58	12.7	13.3	12.2
SR #4	9.1	294	46.4	73.4	90.1	54.0	19	42	8	27	50	25.88	12.7	13.1	12.2
SR #5	8.5	287	41.3	72.0	91.5	47.5	23	55	9	28	49	25.95	12.6	13.2	12.2
SR #6	8.4	276	32.2	75.5	90.0	59.7	16	25	9	25	50	25.74	12.7	13.2	12.2
SR #7	7.6	220	34.5	70.9	83.3	57.0	17	29	9	23	48	24.69	12.7	13.2	12.2
SR #8	8.3	192	35.7	72.7	86.7	56.4	17	31	9	24	49	25.08	12.7	13.2	12.2
SR #9	8.5	216	36.1	75.2	89.7	59.4	16	26	9	24	50	25.66	12.6	13.1	12.0
SR #10	8.2	284	39.0	74.7	90.4	55.5	17	40	9	26	50	25.85	12.7	13.1	12.2
SR #11	8.1	281	38.2	72.5	90.8	48.1	21	50	8	28	49	25.94	12.7	13.3	12.2
SR #12	8.1	283	35.3	73.2	91.9	48.7	20	45	8	27	49	25.96	12.6	13.2	12.2
SR #13	8.9	185	39.8	73.2	86.9	59.5	15	25	9	22	48	25.09	12.6	13.2	12.1
SR #14	8.8	180	35.5	76.1	89.3	62.0	15	26	9	24	50	25.69	12.7	13.2	12.2
SR #15	8.3	213	34.6	73.6	91.5	46.5	21	54	9	28	50	25.97	12.7	13.4	12.2
SR #16	8.1	223	33.1	74.8	92.0	49.4	18	42	8	26	50	25.97	12.7	13.2	12.1

Data are subject to further review and editing. Please refer any questions to the Western Regional Climate Center.

° 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 KW/m²

* Incomplete data. Listed data compiled from available data.

Daily Summary for

Prev Day **June 18, 2005** Next Day

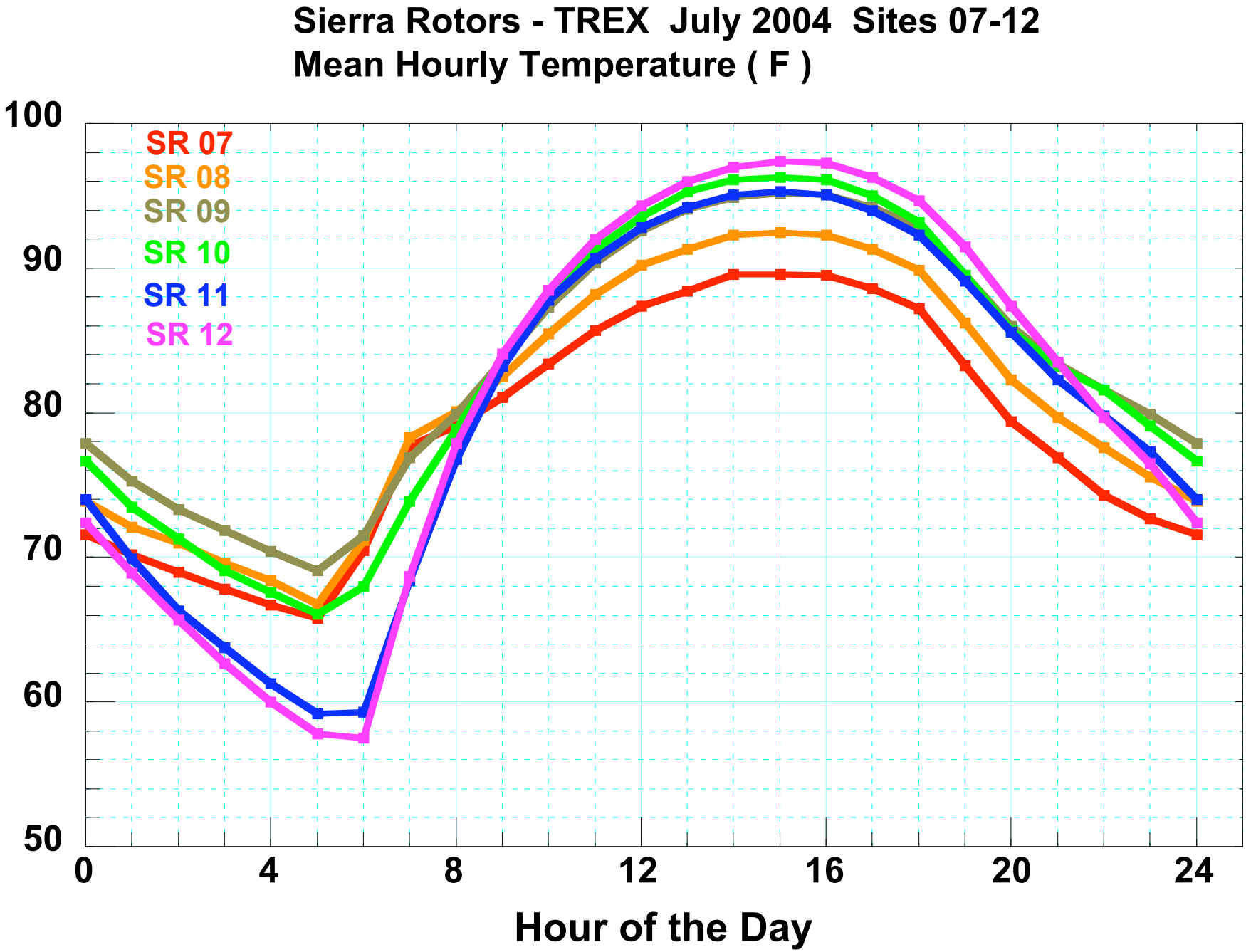
Station	Wind Ave. mph	Wind V. Dir. Deg	Wind Max. mph	Air Temperature Mean Deg. F.	Air Temperature Max Deg. F.	Air Temperature Min Deg. F.	Humidity Mean Percent	Humidity Max Percent	Humidity Min Percent	Dew Point Deg. F.	Wet Bulb Deg. F.	Baro. Press. in. Hg.	Battery Voltage Mean volts	Battery Voltage Max volts	Battery Voltage Min volts
SR #1 *	6.7		21.6	52.5	64.0	42.7	22	30	12	14	37	24.23	12.7	13.3	12.0
SR #2 *	6.8		19.6	55.1	68.0	45.0	22	31	11	17	39	24.99	12.7	13.4	12.1
SR #3 *	8.7		22.3	58.1	71.7	49.2	24	33	13	20	41	25.61	12.7	13.4	12.1
SR #4 *	8.2		22.7	57.9	72.5	44.8	27	47	12	22	42	25.92	12.5	13.2	12.1
SR #5 *	6.7		24.4	55.3	73.1	43.3	29	50	12	22	40	26.00	12.7	13.3	12.2
SR #6 *	5.8		21.2	57.0	72.9	44.8	23	36	12	18	40	25.78	12.7	13.3	12.1
SR #7 *	5.7		20.4	52.9	67.4	40.4	24	35	12	16	38	24.70	12.7	13.3	12.2
SR #8 *	7.4		20.9	54.9	69.9	42.5	23	34	12	17	39	25.10	12.7	13.3	12.2
SR #9 *	9.0		22.9	58.5	72.2	49.0	23	33	12	20	41	25.70	12.5	13.2	12.0
SR #10 *	8.7		22.2	58.9	73.0	46.6	24	42	11	21	42	25.89	12.7	13.2	12.2
SR #11 *	7.5		26.4	55.9	72.2	44.2	28	47	12	22	41	25.98	12.8	13.4	12.2
SR #12 *	6.2		22.0	53.7	73.2	36.6	27	45	12	19	39	26.00	12.6	13.3	12.1
SR #13 *	8.7		20.4	56.5	68.5	45.8	22	31	13	17	40	25.10	12.6	13.3	12.1
SR #14 *	8.7		22.0	59.3	72.4	51.3	22	32	10	20	42	25.72	12.7	13.3	12.2
SR #15 *	5.6		22.1	55.6	73.0	39.2	29	58	12	21	40	26.02	12.8	13.5	12.2
SR #16 *	6.0		21.2	55.5	73.5	38.8	27	49	10	20	40	26.02	12.7	13.4	12.1

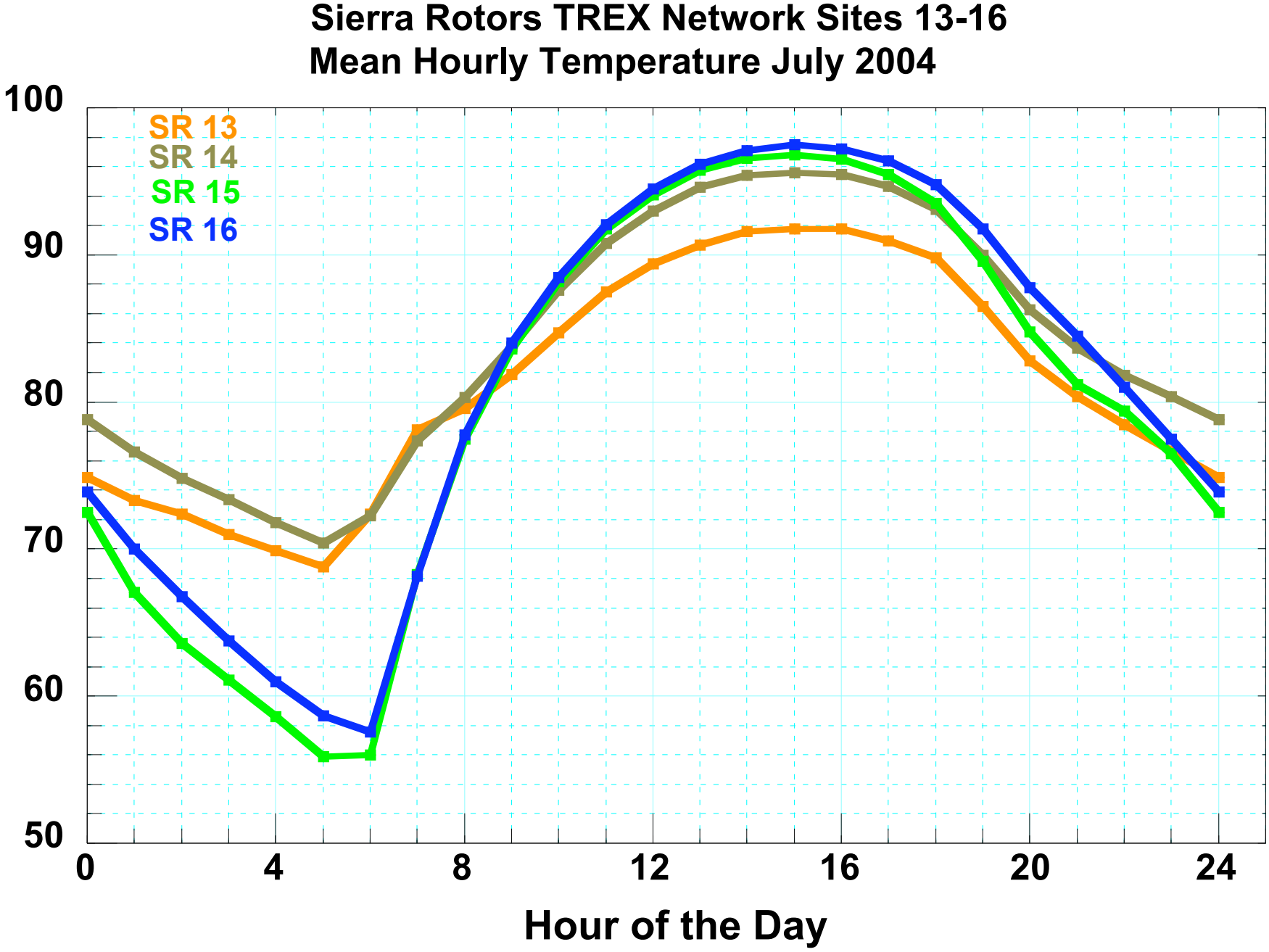
Data are subject to further review and editing. Please refer any questions to the Western Regional Climate Center.

° 1 ly = 1 cal/cm² = 4.1855 J/cm² = 3.6855 BTU/ft² = .01163 KW/m²

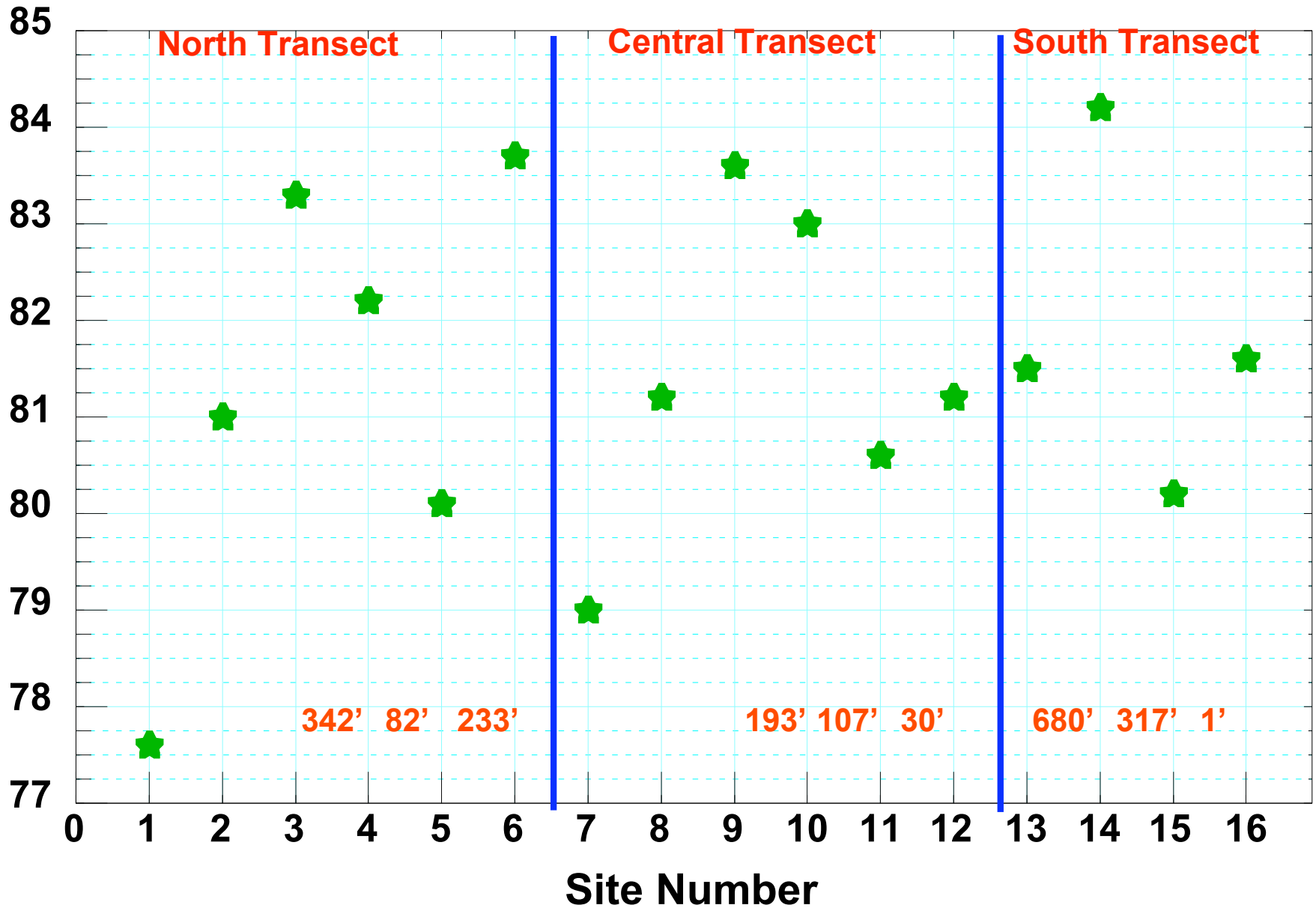
* Incomplete data. Listed data compiled from available data.

Which QC procedures would let these data through?

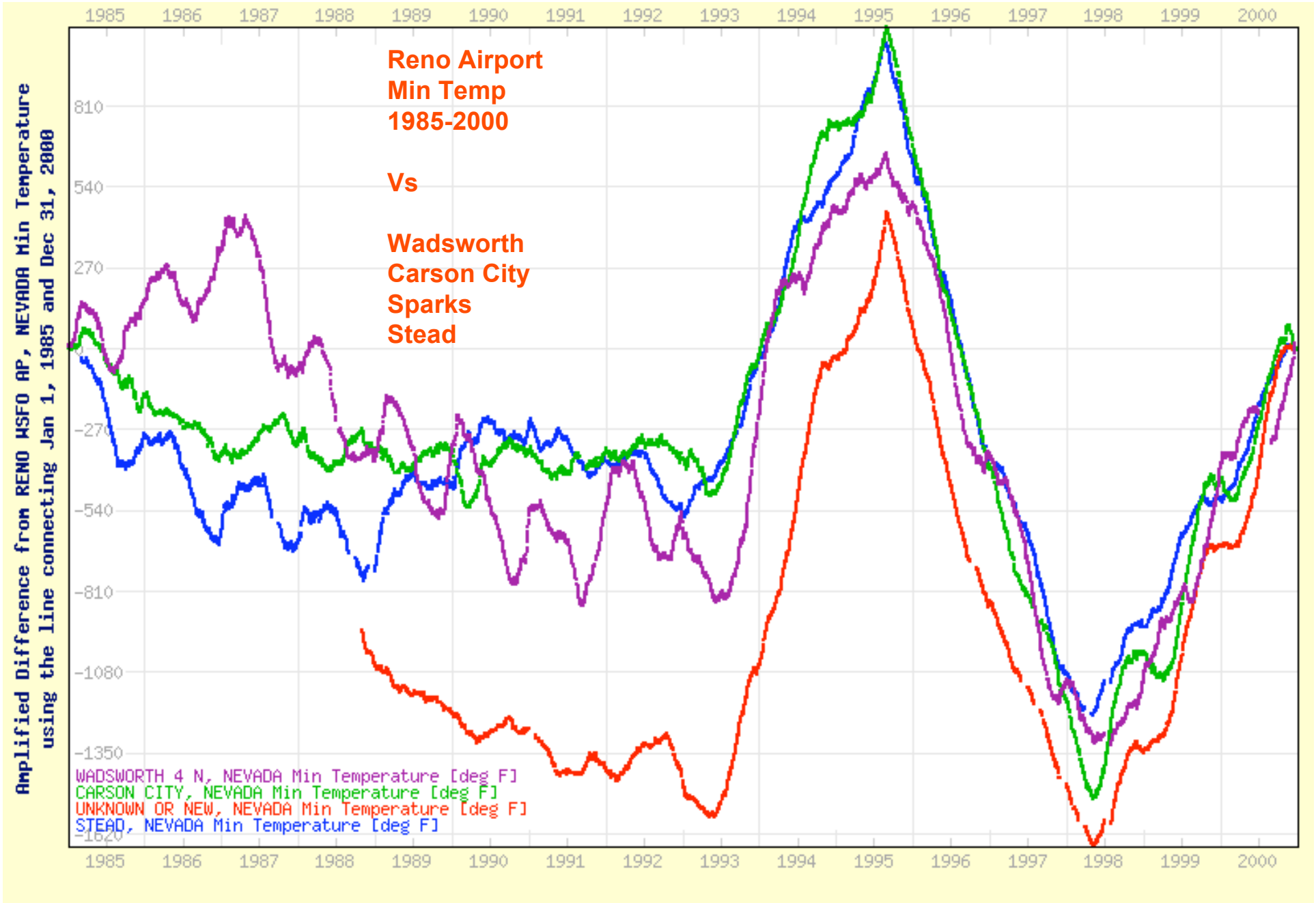

Sierra Rotors - TREX July 2004 Sites 07-12
Mean Hourly Temperature (F)
SR 07
SR 08
SR 09
SR 10
SR 11
SR 12
100
90
80
70
60
50
0
4
8
12
16
20
24
Hour of the Day


Sierra Rotors TREX Network Sites 13-16
Mean Hourly Temperature July 2004
SR 13
SR 14
SR 15
SR 16
100
90
80
70
60
50
0
4
8
12
16
20
24
Hour of the Day

Sierra Rotors / TREX Network
Mean Monthly Temperature (F). July 2004.



Elevation difference between adjoining stations


Amplified Difference from RENO WSFO AP, NEVADA Min Temperature
using the line connecting Jan 1, 1985 and Dec 31, 2000
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
810
540
270
-270
-540
-810
-1080
-1350
-1620
Reno Airport
Min Temp
1985-2000
Vs
Wadsworth
Carson City
Sparks
Stead
WADSWORTH 4 N, NEVADA Min Temperature [deg F]
CARSON CITY, NEVADA Min Temperature [deg F]
UNKNOWN OR NEW, NEVADA Min Temperature [deg F]
STEAD, NEVADA Min Temperature [deg F]